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RESEARCH REPORTS

October 14, 1960

Vol. 34, No. 4

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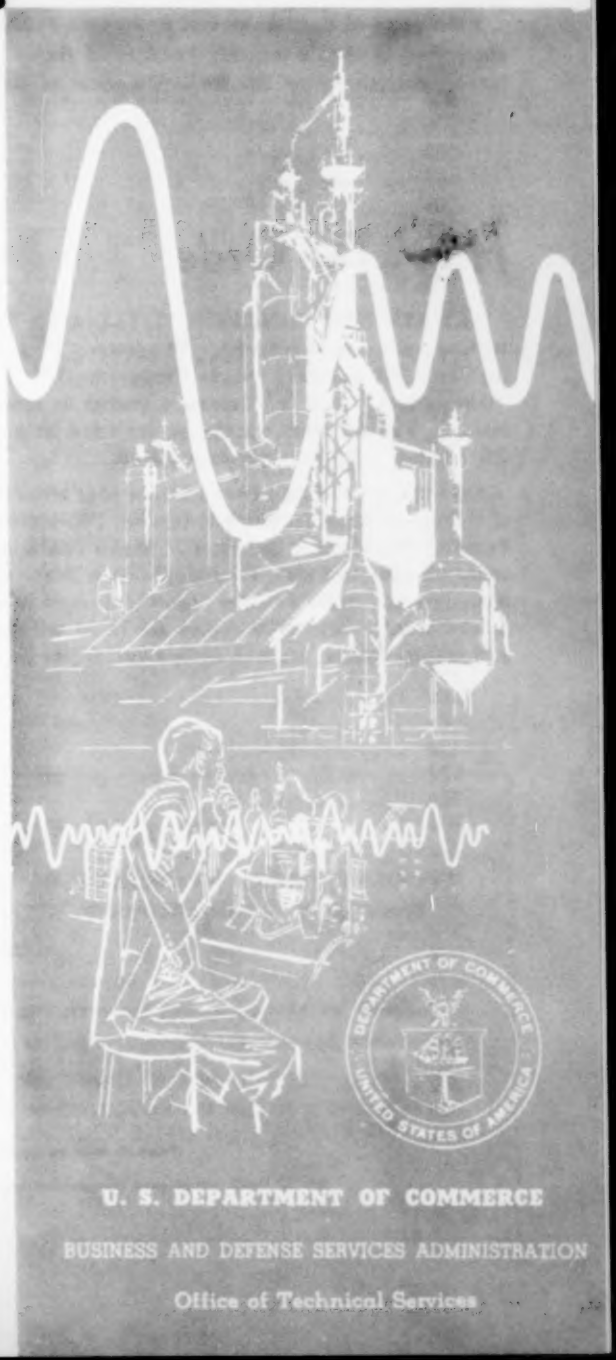

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Engineering Supervision Co., New York.
LITERATURE SURVEY ON RESEARCH AND DEVELOPMENT ON HIGH PRESSURE TECHNOLOGY, by Lawrence Berg and Harry Herman. Rept. for June-Oct 59 on Metallic Materials, Contract AF 33(616)6729. Mar 60, 54p. 295 refs. WADC Technical rept. 59-730.
Order from OTS $1.50 PB 161 887

This bibliography lists alphabetically by author the results of a survey of available literature, both foreign and domestic, classified and unclassified, in the field of high pressure technology. The compiled information includes, for each article, the title, source, page number, number of pages, Chemical Abstract number (CA) Physical Abstract number (Ph. A.), and a general description of the subject matter. Co-authors of any given publication have been cross-referenced. It is intended to reissue this report from time to time as new authors emerge and new publications are reviewed. (Author)

Office of Technical Services, Dept. of Commerce, Washington, D. C.
SOLAR ENERGY APPLICATIONS. July 60, 5p. 68 refs. OTS Selective Bibliography SB-418.
Order from OTS $0.10 OTS SB-418

A bibliography of reports listed in the two OTS monthly abstract journals: U.S. Government Research Reports and Technical Translations.

ASTRONOMY

Air Force Missile Development Center, Holloman AFB, N. Mex.
PLANETARY ASTRONOMY FROM SATELLITE-SUBSTITUTE VEHICLES, by John D. Strong, Gérard H. de Vaucouleurs, and Fritz Zwicky. Mar 60, 163p. 142 refs. AFMDC-TR-60-6; AD-234 813.
Order from LC mi$7.80, ph$25.80 PB 146 964

Contents:
A review of meteorological and astrophysical programs for observatories carried effectively into space by satellite-substitute vehicles
A survey of physical problems of the nearer planets and a review of observational techniques applicable to balloon-borne telescope systems
Program for novel observations from high altitude balloons
(See also PB 145 737)

Air Force Missile Development Center, Holloman AFB, N. Mex.
PLANETARY ASTRONOMY FROM SATELLITE-SUBSTITUTE VEHICLES. II. A SURVEY OF PHYSICAL PROBLEMS OF THE NEARER PLANETS AND A REVIEW OF OBSERVATIONAL TECHNIQUES APPLICABLE TO BALLOON-BORNE TELESCOPE SYSTEMS, by Gerard de Vaucouleurs. Dec 59, 128p. 123 refs. AFMDC-TN-59-37; AD-233 561.
Order from LC mi$6.30, ph$19.80 PB 146 381

A survey is presented of the various techniques immediately available, or soon to become practicable, to solve the main outstanding problems of planetary astronomy. Particular attention is given to the nearer planets, Venus, Mars, and Mercury, which together with the earth form the so-called terrestrial planets group. Special emphasis is placed on the potentialities of balloon-borne instrumentation and on proven techniques rather than experimental developments. (Author) (See also PB 143 187)

Yerkes Observatory [Williams Bay, Wis.]
THE HYDROGEN EMISSION LINES IN POPULATION II VARIABLE STARS, by Robert P. Kraft (Yerkes and McDonald Observatories) David C. Camp, and William T. Hughes (Goethe Link Observatory). Rept. on Contract Nonr-2323(00). [1959] 15p. 23 refs.
AD-219 583.
Order from LC mi$2.40, ph$3.30 PB 146 354

Three groups of variables generally assigned to Population II are considered: RR Lyrae Stars, W Virginis stars, and high-velocity long-period variables. If t is the time hydrogen emission is present in the spectra of these stars, and P is the period, it is shown that

log t ∞ log P. If one assumes that strong shock waves are responsible for the emission, it is found that the strength of the Hβ emission in W Vir can be predicted. It is suggested that the pulsation constant is the same for the stars in all 3 groups, and that the mass of a high-velocity long-period variable is of the order of 1μ.

Ohio State U. Research Foundation, Columbus.
RADIO STAR SCINTILLATION AT 915 Mc, by H. C. Ko. Final rept. on Contract AF 19(604)1591. Apr 59, 48p. 21 refs. Radio Observatory rept. no. 12. AFCRC-TR-59-182; AD-225 686.
Order from LC mi$3.30, ph$7.80 PB 146 611

Observations of radio star scintillation at 915 mc over a 12-month period (October 1957-September 1958) are described. By daily observations of the star constellation Cygnus A (IAU 19N4A) over a wide range of elevation angles, both the amplitude and rate of scintillation were studied. Results show that the amplitude of scintillation is strongest near the horizon and decreases rapidly as the altitude increases. The amplitude of the intensity fluctuation ranges from less than 3% to over 50% of the undisturbed intensity while the rate of fluctuation varies from 1/2 to 8 peaks per min. The fluctuation amplitude was greater than 10% at low altitudes for 71% of the total observations. The frequency of occurrence of scintillation had two maxima: one in the winter and the other in the summer. During these periods the mean fluctuation amplitude was higher than during other periods. The mean fluctuation rate in the winter is about 3 times faster than that in the summer. (Author)

Astrophysics

Aeronautical Instruments Lab., Naval Air Development Center, Johnsville, Pa.
THE EFFECT OF CELESTIAL BODIES ON THE GRAVITATIONAL CONSTANT OF THE EARTH, by Ronald S. Vaughn. Technical note. 15 Oct 59, 19p. 3 refs. Rept. no. NADC-AI-5990(TN); AD-231 985.
Order from LC mi$2.40, ph$3.30 PB 146 963

The gravitational potential at a point near the earth due to the moon and the sun is evaluated in terms of the net specific force with respect to the earth. The maximum possible value near the earth's surface is shown to be about 2.4×10^{-7} g. A constant residual is shown to affect the interpretation placed on the measured value of the earth's gravitational constant. This effect is about 4.5×10^{-6} g. (Author)

Aeronautical Research Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
THE LIMITING DETECTIVITY OF OPTICAL AMPLIFYING EQUIPMENT, by R. K. H. Gebel and Lee Devol. Dec 59, 26p. WADC Technical note 59-405.
Order from OTS $0.75 PB 161 876

The limits in the ability to detect very faint stars in the presence of the sky background by conventional photography and by employing optical amplification are investigated and compared in this paper. Equations are developed which show the effects of the different variables involved for three types of imaging system; the conventional photographic system, the image-converter, and the closed circuit television type of optical amplifier. In this paper, the last named system is found capable of detecting smaller differences in brightness than the two other systems. (Author)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
BIBLIOGRAPHY OF EXTRATERRESTRIAL RADIO NOISE: QUARTERLY LIST OF RECENT PUBLICATIONS [NO. 6] by Martha Stahr Carpenter. Rept. on Contract Nonr-401(22) and National Science Foundation Grant G5964. 15 Dec 58, 19p. 132 refs. Research rept. EE-417.
Order from LC mi$2.40, ph$3.30 PB 148 345

Most of the references pertain to material received between 1 Sep 58 and 1 Dec 58. Also included are certain references to earlier publications that were not mentioned in previous "Quarterly Lists," and a few revised statements of previously listed references about which further information is now available. (See also PB 146 094)

Cornell U., School of Electrical Engineering, Ithaca, N. Y.
RADAR ECHO FROM A ROUGH ROTATING PLANET, by M. H. Cohen. Technical rept. no. 1 on Radio Astronomy, Contract Nonr-401(27). 1 June 59, 23p. 7 refs. Research rept. EE-428; AD-225 628.
Order from LC mi$2.70, ph$4.80 PB 146 587

An assumption is made that the reflection properties of a planet are like those of a rough rotating sphere. A monochromatic wave incident on such a body has an echo whose spectrum is shown to be of the form, $I(\nu) = I_m [1 - 2(\nu - \nu_m)^2/B^2]$ where I is the spectrum, ν is the frequency, and m is the peak intensity. The effect of orbital motions on the width, B, of the spectrum of the echo is deduced. Earth-Mars and Earth-Venus situations are considered. Measurements of B for Venus over a range of orbital positions may fix the rotation period and the heliocentric ecliptic latitude and longitude of the pole, except for one ± ambiguity. If a 2-wk rotation period for Venus is assumed, B has a maximum value of 120 c. (Author)

Iowa State U., Iowa City.
INSTRUMENTATION FOR AURORAL ZONE BALLOON EXPERIMENTS AND SUMMARY OF FIELD OPERATIONS, by Donald C. Enemark and Kinsey A. Anderson. [Rept. on Contract N9onr-938(03)]. June 59, 28p. 4 refs. Rept. SUI-59-17; AD-219 097.
Order from LC mi$2.70, ph$4.80 PB 146 705

Twelve balloon flights were made to obtain information on high latitude cosmic ray effects and x-ray occurring in connection with magnetic storms and other geophysical or solar phenomena. Approximately 150 hours of

data were obtained above 100,000 ft altitude (30 Km). Five flights were made from Fairbanks, Alaska, during April, 1959. This site was chosen because of the very low ground winds encountered there which would facilitate launching large volume balloons. These were desired in order to make measurements with an auroral photometer at altitudes where the Rayleigh scattered sunlight was comparable with auroral brightness. Another feature of the extreme altitude flights was the possibility of studying x-ray effects at very small atmospheric depths. (Author)

Kiruna Geophysical Observatory (Sweden)
STUDIES OF CORRELATIONS BETWEEN UPPER ATMOSPHERE VARIABLES IN THE AURORAL ZONE, by Bengt Hultqvist, Alv Egeland and others. Technical summary rept. Task 6, 15 Oct 58-15 Oct 59, on Contract AF 61(514)1314. 26 Oct 59, 28p. 6 refs. AFCRC-TN-60-148.
Order from LC mi$2.70, ph$4.80 PB 148 810

Study of correlations of satellite data, visual aurora, magnetic variations, and VHF auroral reflections.

Kiruna Geophysical Observatory (Sweden).
STUDIES OF TRANSMISSIONS FROM SATELLITES WITH EMPHASIS ON PROPAGATION ASPECTS, by Ludwik Liszka. Technical summary rept. Task 5, 15 Oct 58-15 Oct 59, on Contract AF 61(514)1314. 15 Oct 59, 46p. 3 refs. AFCRC-TN-60-147.
Order from LC mi$3.30, ph$7.80 PB 148 809

This report contains a discussion of the methods of Doppler and signal strength measurements and of the analysis of the measurements of 1958 δ 2 transmissions. The following phenomena have been studied: (1) the shape of the region of reception and its dependence on ionospheric conditions; (2) from observations of Faraday fading some estimates have been made by means of a digital computer of the total electron amount, and of the components of the unit vector of the geomagnetic field in the ionosphere; (3) the sudden fadeouts of signals which seems to be caused by strong absorption in "clouds" existing at heights of about 300 km; (4) a type of variations of the signal strength possibly connected with ionization produced by the satellite.

Kiruna Geophysical Observatory (Sweden).
A STUDY OF AURORAL PROPAGATION OF 90 Mc/s RADIATION, by Johannes Ortner, Alv Egeland, and Sven Olsen. Technical summary rept. Task 1 and 2, 15 Oct 57-15 Oct 59, on Contract AF 61(514)1314, 20 Oct 59, 109p. 19 refs. AFCRC-TN-60-144.
Order from LC mi$5.70, ph$16.80 PB 148 806

Contents:
Part I: Radio interference in the frequency range 35-100 Mc/s at Kiruna Geophysical Observatory
Part II: A study of auroral propagation of 90 Mc/s radiation by Johannes Ortner
Part III: Studies of the angular properties of VHF-auroral reflections
Part IV: The aurograph, a recorder for receptions obtained by means of rotary antennas

Kiruna Geophysical Observatory (Sweden).
A STUDY OF TRANSPOLAR HF-PROPAGATION, by Johannes Ortner. Technical summary rept. Task 3, 15 Oct 57-15 Oct 59, on Contract AF 61(514)1314. 30 Oct 59, 100p. 5 refs. AFCRC-TN-60-145.
Order from LC mi$5.40, ph$15.30 PB 148 807

HF pulse propagations on 12, 18 and 24 Mc/s have been studied on the transpolar transmission path College, Alaska - Kiruna, Sweden continuously since 20 May 1958. The technical performance of these experiments is described and the reception signal strength tables are given for the observation period June 1958 to August 1959. The monthly mean signal strength diurnal variation curves are presented. Furthermore some examples of multipath propagation are shown and the effect of strong absorption events on the pulse transmissions is discussed. (Author) (Portions of this report will not reproduce well)

Smithsonian Institution, Astrophysical Observatory, Cambridge, Mass.
STUDY OF ATMOSPHERIC ENTRY AND IMPACT OF HIGH VELOCITY METEORITES, by Fred L. Whipple. Quarterly status rept. no. 17, 1 Jan-31 Mar 60, on Contract AF 18(600)1596. 25 May 60, 4p.
Order from LC mi$1.80, ph$1.80 PB 148 019

BEHAVIORAL SCIENCES

Human Engineering

Aerospace Medical Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
A GENERAL PROCEDURE FOR SYSTEMS STUDY, by George O. Wright. Jan 60, 17p. 2 refs. WADD Technical note 60-18; AD-236 040.
Order from OTS $0.50 PB 161 873

The creation of an abstract system model is presented. The model is developed around the concepts of process, data input, system output, function, data transformation, mediation, and operation, outcomes and the output criteria, feedback control, and data flow. The system model also is considered in cultural terms. The thesis is set forth that the man-machine complex is a cultural system whose limits are set by culture. The paper also proposes a methodology for system study. The general procedure is to locate appropriate places in the system to manipulate selected variables and to evaluate the resulting changes in the system performance. A set of principles is developed to assist in the choices of the place to intervene as well as the kinds of variables to be manipulated. (Author)

American Inst. for Research [Pittsburgh, Pa.]
TECHNIQUES FOR HUMAN FACTORS EVALUATION OF PROTOTYPE SPECIAL WEAPONS AND ASSOCIATED EQUIPMENT, SUPPLEMENT I, by James W. Shearer, Dan A. Peterson and Edward B. Slebodnick, Rept. on Contract AF 29(601)513. July 59, 81p. AIR-259-59-FR-198-Sup. I: AFSWC-TR-59-14, sup. I; AD-227 333.
Order from LC mi$4.80, ph$13.80 PB 146 598

This booklet is published as a supplement to AFSWC-TR-59-14, Techniques for Human Factors Evaluation of Prototype Special Weapons and Associated Equipment. The appendices to that report consisted of an Instructions Evaluation Guide (IEG) and an Equipment Evaluation Guide (EEG). The former is compiled of some 300 items for evaluating preliminary manuals of job instructions; the latter, of about 500 items for evaluating prototype equipment of various kinds. These supplements contain the cards for both guides. Supplement I contains the cards for the IEG. Supplement II contains the cards for the EEG. The Instructions section describes the order in which the cards should be used.

American Inst. for Research [Pittsburgh, Pa.]
TECHNIQUES FOR HUMAN FACTORS EVALUATION OF PROTOTYPE SPECIAL WEAPONS AND ASSOCIATED EQUIPMENT, SUPPLEMENT II, by James W. Shearer, Dan A. Peterson, and Edward B. Slebodnick. Rept. on Contract AF 29(601)513. July 59, 186p. AIR-259-59-FR-198-Sup. II; AFSWC-TR-59-14; sup. I; AD-227 331.
Order from LC mi$8.40, ph$28.80 PB 146 591

See also PB 146 598.

Dunlap and Associates, Inc., Stamford, Conn.
OPTIMUM SYMBOLS FOR RADAR DISPLAYS, by Hugh M. Bowen, John Andreassi and others. Rept. on Contract Nonr-2682(00). 1 Sep 59, 36p. 47 refs. AD-227 014.
Order from LC mi$3.00, ph$6.30 PB 148 898

Experiments were conducted to determine: (1) sets of geometric symbols each one of which is discriminated and recognized with high accuracy under a variety of display degradation conditions, and (2) the size and strokewidth to height ratio desirable for symbols to be used on complex displays. Recommendations including appropriate dimensions, are made concerning: (1) optimum geometric symbols: (2) size and strokewidth to height ratio: (3) compliance with the informational structure the symbols are representing: (4) the manner in which symbols are to be compounded to form symbol complexes: and (5) agreement with conventional and stereotyped meanings. (Author)

Dynamic Analysis and Control Lab., Mass. Inst. of Tech., Cambridge.
TIME-VARIABLE DYNAMICS OF HUMAN OPERATOR SYSTEMS, by Thomas B. Sheridan. Rept. for Sep 58-Sep 59 on Contract AF 19(604)4548. Mar 60, 125p. 37 refs. Rept. no. 124; AFCRC-TN-60-169.
Order from LC mi$6.30, ph$19.80 PB 147 732

The human operator of a control system is frequently modelled as a several parameter constant coefficient quasi-linear system, with coefficients dependent upon the process dynamics and the input spectrum. However, an important limitation to such a model occurs in precisely that situation where the human controller out performs his mechanical or electronic counterpart. An experimental technique is developed whereby the frequency characteristics of the human operator (or any physical system) are computed in a running fashion as he adapts to sudden changes in parameters of the reference input, the nature of the operator's display, the controlled process, or physiological conditions within himself. The method utilized a "random appearing" reference input which consists of a sum of non-harmonic sinusoids. Experimental results reveal the time-changes of the human operator's transfer characteristics to be quite consistent and almost instantaneous when the operator is experienced.

Personnel and Training

Human Factors Research, Inc., Los Angeles, Calif.
SUPERVISORY RATINGS AND PRACTICAL PERFORMANCE TESTS AS COMPLEMENTARY CRITERIA OF SHIPBOARD PERFORMANCE, by Robert R. Mackie and Wallace S. High. Technical rept. no. 9 on Research on the Development of Shipboard Performance Measures, Contract Nonr-1241(00). June 59, 59p. 15 refs. AD-220 172.
Order from LC mi$3.60, ph$9.30 PB 146 687

This report describes a shipboard follow-up study of the performance of Navy Machinery Repairmen whose aptitudes, skills, interests and achievements had been thoroughly studied two years earlier while they were in Class "A" MR training. Shipboard performance was assessed in two ways: (1) by administering a practical performance test requiring skill in the use of machinery repair equipment: (2) by securing ratings by supervising petty officers of each person's ability to perform the various aspects of the MR's shipboard job. The results strongly suggested that performance tests and supervisory ratings were best regarded as complementary criteria of shipboard performance. When the two shipboard measures were combined to form a simple composite criterion, it was estimated that over 50% of the true variance was accounted for by scores made two years earlier on a combination of scores made on: (1) mechanical knowledge tests; (2) training projects involving the use of lathe and milling machines: and (3) predictions by school instructors as to eventual suitability as an MR. (Author)

Human Resources Research Office, George Washington U., Washington, D. C.
A PERFORMANCE REQUIREMENT FOR BASIC LAND NAVIGATION, by Joseph F. Follettie. Rept. on Contract DA 49-106-qm-1. Mar 60, 60p. 8 refs. Research rept. no. 4.
Order from LC mi$3.60, ph$9.30 PB 148 318

This report presents the rationale and supporting data that were the basis for establishing a performance requirement and a proficiency standard to be used in evaluating a program of instruction in basic land navigation. The combat reference situation in which navigation ability ultimately will be required was described, and the performance requirement and the means for accomplishing it were assessed. Generation of the requirement was based on characteristics of position defense by a ROCID division. (Author)

Human Resources Research Office, George Washington U., Washington, D. C.
THE REVISION OF NIKE PLATOON LEADER JOB DESCRIPTIONS: AJAX TO HERCULES, by Edgar M. Haverland and Walter J. Fightmaster. Rept. on Contract DA 49-106-qm-1. May 60, 26p. 5 refs. Technical rept. 62.
Order from LC mi$2.70, ph$4.80 PB 148 064

This report describes the sources of information and procedures used to revise the job descriptions of the Nike Ajax integrated fire control platoon leader and launching platoon leader positions to make them applicable to Nike Hercules platoon leader jobs. It outlines the methods found generally useful for revising and developing job descriptions to keep them up to data, and recommends their use by training agencies. The Hercules fire control and launching platoon leader job descriptions developed in this study are included. (Author)

Naval Personnel Research Field Activity, San Diego, Calif.
DEVELOPMENT OF A DOPPLER TEST, by Edward J. Pickering. Oct 59, 19p. 6 refs. BuPers Technical Bulletin 59-27; AD-233 002.
Order from LC mi$2.40, ph$3.30 PB 146 304

Sea-recorded materials were used to: (a) develop and evaluate a test to measure sonarmen's ability to determine Doppler; and (b) provide a set of Doppler items for drills in Doppler training. New test and drill materials were needed because many of the materials available at Fleet Sonar School, San Diego, (FSS/SD) were worn or obsolete. Administration of the experimental 60 item test to 6 classes, 99 students, at the FSS/SD indicated that the test can be expected to accurately discriminate individual differences in Doppler ability. The 50 item Doppler drill which was developed and the test are now in use at the FSS/SD. (Author)

Naval Personnel Research Field Activity, Washington, D. C.
THE DEVELOPMENT OF MEASURES FOR THE EVALUATION OF FT PERFORMANCE, by Kalmer E. Stordahl and J. Howard Bryant. Mar 59, 64p. 8 refs. Technical Bulletin 59-8; AD-233 978.
Order from LC mi$3.90, ph$10.80 PB 147 229

The refinement of prototype procedures and instruments developed to provide economical and effective means for obtaining pertinent and current shipboard data to assess the influence upon personnel performance of policy and program changes is reported.

Naval Personnel Research Field Activity, San Diego, Calif.
AN EXPERIMENTAL INVESTIGATION OF DOPPLER TRAINING, by Edward J. Pickering. Nov 59, 52p. 15 refs. BuPers Technical Bulletin 59-29; AD-233 008.
Order from LC mi$3.60, ph$9.30 PB 146 303

Research and development in Doppler training during and since World War II is described. The effectiveness of Doppler training in improving the ability of sonar students to determine Doppler is evaluated, and planned modifications of Doppler training to increase the effectiveness of Doppler training are investigated. The results of this research indicate that: (1) the average ability of sonar students to judge Doppler is significantly improved through training; (2) the particular instructor who teaches Doppler greatly affects the results of training; (3) students who are poor judges of Doppler before training do not, even though they improve, reach a proficiency level adequate for fleet performance; (4) initially superior judges of Doppler improve through training and do maintain a proficiency level adequate for fleet performance; and (5) from an economics viewpoint more might be accomplished by selecting for Doppler ability than by training poor judges of Doppler. (Author) (See also PB 146 304)

Naval Personnel Research Field Activity, San Diego, Calif.
THE PROFICIENCY OF PACIFIC FLEET SONARMEN IN THE USE OF ELECTRONIC TEST EQUIPMENT, by Adolph V. Anderson and Edward J. Pickering. Nov 59, 30p. BuPers Technical Bulletin 59-30; AD-233 620.
Order from LC mi$2.70, ph$4.80 PB 147 274

A test designed to measure ability to use electronic test equipment was administered to 396 Pacific Fleet sonarmen as part of a general survey of sonar personnel. On the average, the ability of sonarmen to operate volt ohm meters, vacuum tube volt meters, oscilloscopes, and signal generators was poorer than desirable. Sonarmen below the grade of chief petty officer who were assigned to helicopter squadrons performed at a lower level than sonarmen in other assignments. Possible remedial measures include the development of standard proficiency measures in the practical application of electronic test equipment; the development of one or more experimental training courses in the use of electronic test equipment; administrative action to cause closer agreement between practical factors requirements for sonarmen and performance on electronic test equipment; and the investigation of the feasibility of developing a training device to provide simulated experience in the use of electronic test equipment. (Author)

Naval Personnel Research Field Activity, San Diego, Calif.
A STUDY OF WEIGHTING FACTORS USED IN NROTC SELECTION, by Bernard Rimland. July 59, 28p. 11 refs. BuPers Technical bulletin 59-24; AD-231 132.
Order from LC mi$2.70, ph$4.80 PB 146 344

The weighting of the various selection factors in NROTC NROTC selection was explored. The findings indicate that weighting the Navy College Aptitude Test scores by a factor of 4 and weighting High School Grades by a factor of 6 resulted in the greatest assurance of academic success. In order to predict career motivation it was determined that equal weights should be assigned to the Career Motivation Questionnaire and to the career motivation item on the Interview Form. Though the interview (other than the career motivation item) has never been found to be very valid in the Navy setting, it has in the past been given approximately 50% of all the selection weight by the State Selection Committees. A new selection procedure has been developed

and promulgated by the Chief of Naval Personnel for use by the State Selection Committees. They should result in giving greater weight to the academic and career motivation factors and reducing the effective weight assigned to the interview. (Author)

Psychological Corp., New York
AN APPLICATION OF LEARNING THEORIES TO THE TRAINING OF RADIO CODE OPERATORS. by Albert K. Kurtz. Technical rept. no. 2 on Contract Nonr-2519(00). Sep 59, 19p. 8 refs. AD-226 228.
Order from LC mi$2.40, ph$3.30 PB 148 612

In order to determine the relative merits of two experimental methods and a control method of training radio code operators to receive International Morse Code at a high rate of speed, Navy recruits undergoing training in radio code were subjected to special instruction, some during the first two, and others during the first 4 weeks of their 24 week course. Some of the learning principles utilized in the experiment were; reinforcement, maintenance of interest, prevention of learning of erroneous responses, unidirectional confusion, overlearning, concentration on difficult material, development of ability to respond to stimulus within varied contexts, realism, and praise and encouragement. The four-week experimental method proved more effective than the two-week method. Although the results of tests with the control group were slightly higher than those with the experimental four-week group, it was felt that the experimental method may actually be superior to the control method. Apart from teaching effectiveness, the experimental method produced an intrinsically more interesting course than the control method, and it was suggested that some of the former's characteristics might be used in the later stages of the twenty-four week course to combat monotony. This should improve the present low morale of radio code students.

Psychological Corp., New York.
RECENT DEVELOPMENTS, PRACTICES, AND RESEARCH IN THE FIELD OF CODE LEARNING, by Albert K. Kurtz. Technical rept. no. 1 on Contract Nonr-2519(00). Sep 59, 54p. 45 refs. AD-227 063.
Order from LC mi$3.60, ph$9.30 PB 148 611

Contents:
Transmission speeds for code-reception practice
Tone speed
Order of presentation of signals
Rate of introduction and grouping of signals
Amount of practice per signal
Types of practice materials
Code-voice method
Learning theory, instructional techniques, and training aids
Arrangement of practice time
Typical progress in code learning
Code-reception errors
Accuracy standards
Variety and antimonotony procedures
Prediction of success after training has begun
Code sending
Code typing
Criteria of code receiving proficiency

School of Aviation Medicine [Brooks] AFB, Tex.
PROBABILITY AND STATISTICS IN ITEM ANALYSIS AND CLASSIFICATION PROBLEMS. SOME RESULTS ON THE DISTRIBUTION OF THE W-CLASSIFICATION STATISTIC, by Rosedith Sitgreaves (Teachers Coll., Columbia U.). Sep 57, 23p. 4 refs. Rept. 58-3; AD-157 697.
Order from LC mi$2.70, ph$4.80 PB 146 181

The classical problem of classification is concerned with classifying an individual as coming from one of two populations, on the basis of p measurements made on him. It is assumed that the p measurements have a multivariate normal distribution in each population with the same covariance matrix but with different mean values. The parameter values are unknown but can be estimated from samples of known population. The present paper gives a series representation for the sampling distribution of the classification statistic W, proposed for this problem by Anderson, in the case when the two samples of known population are of equal size. (Author)

Washington U., Seattle. [Div. of Counseling and Testing Services]
DIFFERENTIAL PREDICTION OF ACADEMIC SUCCESS, by Paul Horst. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C3). May 59, 37p. 33 refs.
Order from LC mi$3.00, ph$6.30 PB 146 463

The report is divided into the following parts: (A) Philosophy and principles of differential prediction: (B) Variables of differential prediction: (C) Methodological research: (D) Experimental research: (E) Application of the differential prediction program: (F) High speed electronic computer programs: (G) Special problems: and (H) Need for cooperative programs.

Washington U., Seattle. Div. of Counseling and Testing Services.
RELATIONSHIP BETWEEN PREADMISSION VARIABLES AND SUCCESS IN COLLEGE, by Paul Horst. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C3). June 59, 121p. AD-219 274.
Order from LC mi$6.30, ph$19.80 PB 146 691

The relationships between certain preadmission and college success variables, as determined by grade point averages, were studied. Three general types of admissions variables were analyzed: (a) high school grades, (b) number of high school units, and (c) test scores. The main part of the study was concentrated on the group of students entering the University of Washington in the fall of 1955, but data from the entering classes of 1953 and 1954 were also included for comparative purposes. In all, over 7,500 students were included. The results of the study indicate that: (1) the best preadmission predictors vary greatly from one college course area to another; (2) the best group of predictors are the high school grade point averages; (3) the next best group of predictors are test scores; (4) number of high school units are, in general, poor or very poor predictors of college success as measured by grade point averages; (5) the single best preadmission variable is the all academic high school grade point average; and (6) the grade predictions based on a number of different high school grade

averages and test scores are better predictors of college success than all academic high school grade point average. (Author)

Psychology

Applied Psychology Panel, Office of Scientific Research and Development.
THE USE AND DESIGN OF SYNTHETIC TRAINERS FOR MILITARY TRAINING, by Dael Wolfle. 6 July 45, declassified 8 Mar 55. 42p. 37 refs. OSRD rept. no. 5246; ATI-35 348.
Order from LC mi$3.30, ph$7.80 PB 146 809

A good trainer has three essential characteristics: (1) practice on the trainer leads to substantial improvement on the equipment the men are being trained to operate; (2) a good trainer provides reliable information on the quality of the men's performance; (3) mechanically and electrically it is as simple and rugged as possible. It is necessary to plan carefully an instructional program using a trainer. Instructions for the proper use of a trainer should be prepared as the trainer is being developed, and distributed with the trainer. Trainers possess some advantages over real equipment for practice. (1) They are generally safer, more economical, and more readily available. (2) On a trainer it is possible to break up a complex task into simpler elements. (3) It is usually easier to give men exact information about their errors and successes on a trainer than on real equipment. The steps to follow in developing a new trainer or in evaluating an existing one are outlined in this report.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
APPLICATION OF STIMULUS SAMPLING THEORY TO SITUATIONS INVOLVING SOCIAL PRESSURE, by Patrick Suppes and Franklin Krasne. Technical rept. no. 24 on Contract Nonr-225(17). 10 Sep 59, 39p. 12 refs. AD-226 681.
Order from LC mi$3.00, ph$6.30 PB 148 614

The hypothesis that ultimately group behavior can be explained entirely in terms of the behavior of the individuals who constitute the group is presented. The quantitative formulations of stimulus-response-reinforcement theory provide the conceptual tools for effecting this assumption. An interaction situation is conceived of as one in which each member of a group provides stimuli and reinforcements for every other member of the group with the behavior of each member entirely explicable on an individual basis, given the sequence of stimuli and reinforcements impinging on him. In the social situation objective stimuli and the behavior of other members of a group combine to form the relevant stimulus situations for each subject. It is felt that considerable analytic advantage is derived from the application of a quantitative theory of individual behavior. Through its use it is possible to make highly specific deductions about the extent of operation of certain events which are not directly observable but which may reasonably be postulated to exist; i. e., secondary self-reinforcement of responses well established in everyday experience. The magnitude of the effects of these secondary reinforcements is compared to that of the more directly controlled social support.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
STIMULUS SAMPLING THEORY FOR A CONTINUUM OF RESPONSES, by Patrick Suppes. Technical rept. no. 25 on Contract Nonr-225(17). 11 Sep 59, 38p. 4 refs. AD-226 640.
Order from LC mi$3.00, ph$6.30 PB 148 615

Stimulus sampling theory is extended to situations involving a continuum of possible responses. The experimental situation consists of a sequence of trials. On each trial the subject makes a response from a continuum of possible responses. His response is followed by a reinforcing event indicating the correct response for that trial. Stimulus sampling theory requires a complicated process which involves the conditioning and sampling of stimuli. The postulate is given that the conditioning of each stimulus is smeared over a certain interval of responses, possibly the whole continuum. Thus, the conditioning of any stimulus may be represented by a smearing distribution. Conditioning, sampling and response axioms are presented which state specific hypotheses about the assumed sequence of events on any trial. General theorems are given, and cases of noncontingent reinforcement are examined.

California U., Berkeley.
THE STABILITY OF PERSONALITY RATINGS OVER TWO DECADES, by Read D. Tuddenham. Technical rept. no. 3 on Adolescent Growth Study, Contract [Nonr-222(14)]. 1957, 39p. 9 refs.
Order from LC mi$3.00, ph$6.30 PB 148 822

The present report is concerned with the stability of a broad variety of personality ratings, an important class of variables often used in psychological research as criterion measures. The findings are offered despite certain methodological shortcomings--few cases and a lack of strict comparability in the "before" and "after" rating contexts--because of the extreme paucity of such reports, and because of the light the results throw upon the predictive validity of ratings explicitly intended to tap different levels of personality organization.

California U., Berkeley.
STUDIES IN CONFORMITY AND YIELDING. III. THE SEX COMPOSITION OF THE GROUP AS A DETERMINANT OF YIELDING TO A DISTORTED NORM, by Read D. Tuddenham, Philip D. Macbride, and Victor Zahn. Technical rept. no. 4 on Contract [Nonr-222(14)]. 1958, 8 refs.
Order from LC mi$2.40, ph$3.30 PB 148 823

This report describes an experiment intended to explore the influence upon yielding of the structure of the normative social situation and the qualities attributed to those who compose it.

California U., Berkeley.
STUDIES IN CONFORMITY AND YIELDING. IV. THE INFLUENCE UPON JUDGMENT OF AN AVOWEDLY DISTORTED NORM, by Read D. Tuddenham. Technical rept. no. 5 on Contract [Nonr-222(14)]. 1958, 29p. 5 refs.
Order from LC mi$2.70, ph$4.80 PB 148 824

A norm need not be believed to exert influence, and the effectiveness of palpably false propaganda may become somewhat more intelligible. To explore this matter further, an earlier experiment on yielding was repeated exactly, except for explaining to the subjects that the alleged norm was itself distorted and not always trustworthy. (See also PB 148 823)

California U., Berkeley.
STUDIES IN CONFORMITY AND YIELDING. V. THE INFLUENCE UPON JUDGMENT OF A MODERATELY DISTORTED NORM, by Read D. Tuddenham. Technical rept. no. 6 on Contract [Nonr-222(14)]. 1958, 15p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 148 825

The present experiment attempts, under conditions of laboratory control, to investigate the more typical situation in which the discrepancy between self and others is moderate, and the group norm, if not veridical, is at least not grossly false. In this treatment, tension arising from awareness of discrepancy between self and others is much reduced, but the validity of the norm is not undermined. This paper describes the individual and group differences which result as compared with the other experimental variations. It is specifically concerned with whether reduced pressure produces a substantial number of nonyielders, or whether the relatively greater acceptability of the pseudonorm actually enhances its influence upon judgment. (See also PB 148 824)

California U., Berkeley.
STUDIES IN CONFORMITY AND YIELDING. VI. THE INFLUENCE UPON JUDGMENT OF A GENUINE NORM, by Read D. Tuddenham. Technical rept. no. 7 on Contract [Nonr-222(14)]. 1958, 13p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 148 826

The present paper describes the limiting case when the norm itself is genuine and undistorted, but all other variables of the situation match those of the previous experiments. While formally related to the previous studies, the present variation is properly a study of conforming rather than of yielding, since the subjects need not surrender their own judgments to accept those of the group. The two hypotheses of this investigation were suggested by previous experiments, and may be stated as follows: first, a norm which does not conflict with individual experience induces convergence of judgment in the group; second, this convergence is more marked the greater the ambiguity of the stimulus situation, i.e., most marked on opinions, least marked on visual discriminations. (See also PB 148 825)

California U., Berkeley.
STUDIES IN CONFORMITY AND YIELDING. VII. SOME CORRELATES OF YIELDING TO A DISTORTED GROUP NORM, by Read D. Tuddenham. Technical rept. no. 8 on Contract [Nonr-222(14)]. 1958, 16p. 11 refs.
Order from LC mi$2.40, ph$3.30 PB 148 827

The present report is concerned with the correlations between yielding score and a variety of other scores and ratings available on the experimental subjects. (See also PB 148 826)

California U., Berkeley.
STUDIES IN CONFORMITY AND YIELDING. VIII. THE YIELDING EXPERIMENT FROM THE POINT OF VIEW OF THE SUBJECT, by Read D. Tuddenham and Philip D. Macbride. Technical rept. no. 9 on Contract [Nonr-222(14)]. 1958, 33p. 11 refs.
Order from LC mi$3.00, ph$6.30 PB 148 828

The present paper pursues the inquiry further by considering what experimental subjects had to say about their experience, and what relationships exist between the way a subject perceived the situation and his tendency to yield. (See also PB 148 827)

California U., Berkeley.
STUDIES IN CONFORMITY AND YIELDING. IX. INFLUENCE OF CONFIDENCE UPON RESISTANCE OF PERCEPTUAL JUDGMENTS TO GROUP PRESSURE, by Philip D. Macbride. Doctoral thesis. Technical rept. no. 10 on Contract [Nonr-222(14)]. 1958, 40p. 10 refs.
Order from LC mi$3.00, ph$6.30 PB 148 829

The present research explored the relationship between confidence and yielding. It was hypothesized that yielding is an inverse function of confidence and that confidence in one's perceptual judgments is at least in part dependent on the accuracy with which one has made similar judgments in the past. Two principal questions were investigated: (1) do subjects who are "good" at a given perceptual task, that is, make few errors, yield less than subjects who are not? and (2) will subjects who are forced to make errors on a training series subsequently yield more than subjects who are not? (See also PB 148 828)

California U., Los Angeles.
A THEORY OF STIMULUS DISCRIMINATION LEARNING, by Richard C. Atkinson. Technical rept. no. 1 on Contract Nonr-233(58). 11 May 59, 38p. 20 refs.
Order from LC mi$3.00, ph$6.30 PB 146 602

This paper presents a theory of discrimination learning. For simplicity, the analysis will be restricted to situations where only one of two stimuli is presented on each trial; the subject's task is to learn to respond appropriately to them. However, the theory can be readily generalized to situations involving more than two stimuli. The experimental situation involves a series of discrete trials. On each trial one of two stimuli (S_1 or S_2) is presented. To the presentation of S_1, the subject makes one of two responses (A_1 or A_2); these responses are mutually exclusive and exhaustive.

Colorado U., Boulder.
SOME PERSONALITY CORRELATES OF CONCEPT CHANGE BY ENTERTAINMENT OF CONTRADICTORY PREMISES, by O. J. Harvey and Don Beverly (U. of Florida). Technical rept. no. 1 on Contracts Nonr-1147(07) and Nonr-2149(02). [1959] 22p. 19 refs. AD-225 586.
Order from LC mi$2.70, ph$4.80 PB 148 564

Under the assumption that concepts or opinions once formed channel an individual's cognitive functioning and blind him to alternatives not implied in the concept,

137 subjects (Ss) were exposed to treatments designed to render their conceptual schema less closed. Individuals higher in authoritarianism were assumed to be more disposed toward keeping their concepts intact. Subjects with a strong stand against the sale and drink of alcohol were exposed to a communication favoring sale of alcohol which was presented to them as having come from a source of either high or low authoritativeness. Following exposure to the communication, half of the Ss were retested on their attitudes toward alcohol (No Role condition) while the other half were retested after they had written arguments in favor of alcohol (Rode condition). Subjects were also tested on their accuracy of perception of the major arguments in the communication. The more authoritarian Ss showed less change in their opposition to alcohol following their presentation of arguments favorable to it. They also failed to perceive the main arguments of the pro-wet communication to an extent significantly greater than did Ss lower on this dimension. The authoritativeness of source did not significantly interact with authoritarianism and role playing was expected.

Educational Testing Service, Princeton, N. J.
DEVELOPMENT OF THE TEST "FORMULATING" HYPOTHESES", by Norman Frederiksen. Rept. on Contract Nonr-2338(00). June 59, 26p. AD-218 573.
Order from LC mi$2.70, ph$4.80 PB 146 407

The steps in the development of an experimental test called Formulating Hypotheses are described. The test is intended to measure ability to interpret data in the manner of a research scholar who is trying to make sense of research findings. Statistical results obtained in the course of development of the test are described. (Author)

Educational Testing Service, Princeton, N. J.
EXPERIMENTAL STUDIES OF HOMOGENEOUS GROUPING. A REVIEW OF THE LITERATURE, by Ruth B. Ekstrom. Rept. on Contract Nonr-2214(00). Apr 59, 30p. 44 refs.
Order from LC mi$2.70, ph$4.80 PB 146 461

The findings of this survey can be divided into three major groups: (a) thirteen studies which found differences, having or approaching significance, favoring homogeneous grouping, (b) fifteen studies which found no differences in achievement in homogeneous or heterogeneous groups, or which found homogeneous grouping detrimental, and (c) five studies which gave mixed results, partially favorable and partially unfavorable to homogeneous grouping. The studies covered grade levels from elementary school through college and dealt with a wide range of subject matter. No consistent pattern for the effectiveness of homogeneous grouping was found to be related to age, ability level, course content, or method of instruction.

Family Relations Center, San Francisco, Calif.
CHANGES IN NONCONFORMIST ATTITUDES INDUCED BY CLOSED LIVING GROUPS, by E. K. Gunderson, J. Douglas Grant, and Kelley B. Ballard. Technical rept. no. 12 on The Rehabilitation of Naval Disciplinary Offenders, Contract Nonr-1535(00). 28 July 59, 31p. 7 refs. AD-226 285.
Order from LC mi$3.00, ph$6.30 PB 147 187

The relationship of attitude-change of delinquency-prone subjects to the following factors in the closed living group design was studied: (1) subject's maturity level; (2) effectiveness of the supervisory team; (3) interaction of these variables; (4) the maturity level of the group; and (5) duration of the supervisor-group relationship. The findings indicated that delinquency-prone attitudes could be significantly reduced in high maturity confinees by utilizing a closed living group program with effective supervision over a period of 9 weeks. High maturity confinees have a potential for attitude-change, but, unless subjected to an appropriate retraining program, this potential is not realized.

Family Relations Center, San Francisco, Calif.
THE RELATIONSHIP OF DELINQUENCY POTENTIAL SCALE SCORES OF NAVAL RECRUITS TO LATER MILITARY PERFORMANCE, by E. K. Gunderson, Kelley B. Ballard, and P. S. Huge. Technical rept. no. 9 on The Rehabilitation of Naval Disciplinary Offenders, Contract Nonr-1535(00). 8 July 59, 27p. 6 refs. AD-226 283.
Order from LC mi$2.70, ph$4.80 PB 147 186

A 119-item scale for measuring delinquency-prone social attitudes was administered to a sample of 20,000 Navy recruits. A follow-up survey of the military records of these men was made 3 yr later. From this survey a sample of 1339 men who had shown serious nonconformity and 882 men with clear records high conduct marks was obtained. The following variables were studied to determine their relationship to later delinquent behavior: (1) age at enlistment; (2) school grade completed; (3) General Classification Test scores; (4) Armed Forces Qualification Test scores; and (5) scores on the Camp Elliott Delinquency Potential Scale (DP). Applying the criteria 17 years of age, tenth grade or less education, and DP score above 24 in recruit screening should reduce the number of serious disciplinary offenders in the fleet by almost 20% while eliminating only 8% of the total recruit population. The majority of the nonoffenders screened out would be of poor or marginal quality for the Naval service.

Family Relations Center, San Francisco, Calif.
RESTORATION PREDICTION SCALES, by Kelley B. Ballard, R. R. McHenry and J. Douglas Grant. Technical rept. no. 14 on Rehabilitation Research, Contract Nonr-1535(00). 28 July 59, 14p. 4 refs. AD-226 391.
Order from LC mi$2.40, ph$3.30 PB 147 188

Over the past four years, an attitude test consisting of true-false items has been administered to Navy and Marine court-martialed prisoners as they entered a Retraining Command. The items have been repeatedly analyzed against a success-upon-restoration-to-duty criterion. Resulting scales have low reliabilities and validities. However, poor as these scales are, they have norms which suggest that 50% of the confinees could be returned to duty with an 85% success rate. Present screening returns 50% with less than 60% succeeding. A separate report will cover efforts at restoration prediction based upon forced-choice responses at times of release from confinement. It may be that

several components such as these can be combined into a more powerful predictive instrument. (Author)

Laboratory of Social Relations, Harvard U., Cambridge, Mass.
PERCEPTUAL AND COGNITIVE PROCESSES IN INTERPERSONAL RELATIONS, by Renato Tagiuri. Final rept. on Contract N5ori-07670. 30 June 59, 33p. 17 refs. AD-218 783.
Order from LC mi$3.00, ph$6.30 PB 146 683

Contents:
Perception and cognition of persons as objects
Symposium on person perception
Perception of feelings of like and dislike among members of groups
Perceptual grouping as a basis for visibility of interpersonal choice
Mutuality and its statistical significance
Unit formation in the perception of interpersonal attitudes
Interpersonal choice as a stimulus
Perceptual failure
Sociometric status and the meaning of choice
Comparing perception of choice and rejection
Influence and liking as dimensions of dyadic relationships
Cognitive and perceptual processes in judging people
Operating characteristics of trait lists and scales
Sex differences in inferring personality traits
Movement as a source of information about a person
Miscellaneous projects
Role differentiation and estimates of group opinion
Sociometric procedure and its effect upon choice status

Maryland U., College Park.
ASSOCIATIVE STUDIES OF COMPLEX CLUSTERING EFFECTS, by Charles N. Cofer. Technical rept. no. 26 on Learning, Retention, and Recovery of Meaningful Material, Contract Nonr-595(04). June 59, 15p. 5 refs. AD-220 522.
Order from LC mi$2.40, ph$3.30 PB 146 689

Associative data are presented which seem to be consistent with the general notion that the complex clustering effects reported by Gonzales and Cofer (AD-209 896) are probably attributable to shifts in distributions of associated responses as a consequence of various arrangements of modifiers. The 6 complex clustering effects which were discussed are: (1) specificity effect; (2) inappropriate modification effects; (3) mediation effects; (4) mediated conflict effects; (5) mediated facilitation effects; and (6) adverb-verb effects.

Maryland U., College Park.
IMMEDIATE RECALL OF SENTENCES AND THE FACTORS OF MEANINGFUL AND ASSOCIATIVE RELATIONS AMONG SOME OF THEIR CONSTITUENT WORDS, by Charles N. Cofer and Jean C. Holroyd. Technical rept. no. 24 on Learning, Retention, and Recovery of Meaningful Materials, Contract Nonr-595(04). June 59, 15p. 6 refs. AD-220 230.
Order from LC mi$2.40, ph$3.30 PB 146 690

Experiment failed to find evidences in recall of sentences of effects of having nouns and/or adjectives categorized or not. Expectations based on an earlier report by Gonzalez and Cofer (1958) were thus not realized. However, evidence was obtained that associative connections among words, as measured in a free association test, may affect recall under some conditions. (Author)

Psychological Labs., Carnegie Inst. of Tech., Pittsburgh, Pa.
VARIABLES UNDERLYING SOCIOMETRIC STATUS, by E. P. Hollander. Final rept. on Contract Nonr-1849(00). June 59, 4p. 17 refs. AD-233 055.
Order from LC mi$1.80, ph$1.80 PB 146 686

Psychological Labs., Carnegie Inst. of Tech., Pittsburgh, Pa.
VARIABLES UNDERLYING SOCIOMETRIC STATUS, VII. AN EXPERIMENTAL STUDY OF IDIOSYNCRATIC BEHAVIOR AND STATUS, by E. P. Hollander. Technical rept. on Contract Nonr-1849(00). May 59, 12p. 2 refs. AD-233 054.
Order from LC mi$2.40, ph$3.30 PB 146 522

A study is presented to test the view that leadership status, measured in terms of influence acceptance, is affected by both the leader's task competence and his conformity or non-conformity over time. Data were gathered in a laboratory setting from 12 groups of 5 members each, one of whom was a confederate who had manifestly high task competence over the total of 15 trials and was used as a stimulus person. Non-conformity by him to the agreed upon procedural norms of the group was introduced experimentally at various times, e.g., early or late, by zones of 5 trials each. Influence was measured by the number of trials per zone of 5 in which the confederate's recommended solution was accepted as the group's choice. The overall increase in influence acceptance over the total of 15 trials was quite marked as a function of the accumulation of successive evidences of task competence by the confederate. But within this broad effect it was found that the absence of past non-conformity by the stimulus person was positively related to the group's acceptance of his influence. However, there was an interaction effect in the predicted direction such that non-conforming behavior after a zone of conforming behavior yielded high influence acceptance. (Author) (See also PB 145 214)

Psychological Labs., Harvard U., Cambridge, Mass.
INFORMATION AVAILABLE IN A BRIEF VISUAL PRESENTATION. by George Sperling (Bell Telephone Labs.). Appendix A included in Final rept. 29 May 57-31 Jan 59, on Contract AF 33(038)14343. 31 Dec 59, 56p. 85 refs. AFCRC TR-60-50.
Order from LC mi$3.60, ph$9.30 PB 148 784

An improved estimate of short-term memory for visual displays was obtained by giving a signal subsequent to the presentation that selects the element of the display on which the subject is to report. Papers prepared and brief summaries of each item on the contract are also listed.

Research Center for Group Dynamics, U. of Michigan, Ann Arbor.
STUDIES IN SELECTION LEARNING. II. THE EFFECT OF INFORMATIVE AND UNINFORMATIVE CUES ON THE ACQUISITION AND RETENTION OF INTENTIONAL ITEMS, by Eugene Burnstein. Technical rept. no. 2 on Contract AF 49(638)367 and National Science Foundation Grant G-4951. Oct 59, 12p. 7 refs. AFOSR-TN-60-263; AD-231 032.
Order from LC mi$2.40, ph$3.30 PB 146 311

The purpose of this study was to examine the effect of the informativeness of the selection cue on acquisition and retention under conditions of selection learning. In selection learning, unlike ordinary verbal note learning, subjects learn a set of items which are interspersed among incidental items to be ignored. The selection cue differentiates between the intentional and incidental items. The findings indicate a significant effect in memory deriving from the informativeness of the selection cue. In the informative condition the intentional items consisted of two odd and one even digit numbers and the incidental items of three even digit numbers and subjects were instructed to learn only the former. In the uninformative condition both sets of items were the same but the intentional items were preceded by three taps and incidental by two taps, and subjects were instructed to learn only those preceded by three taps. No mention of the digital composition of the items was made. The findings show that when the cue is uninformative, performance in acquisition and retention is the same as in ordinary verbal rote learning. With informative cues, however, a significant gain in recall is obtained. (Author)(PB 145 101)

Research Center for Group Dynamics, U. of Michigan, Ann Arbor.
STUDIES IN SELECTION LEARNING. III. FACILITATION AND INTERFERENCE EFFECTS IN SELECTION LEARNING, by Eugene Burnstein. Technical rept. no. 3 on Contract AF 49(638)367 and National Science Foundation Grant G-4951. Oct 59, 19p. 2 refs. AFOSR-TN-60-264; AD-233 378.
Order from LC mi$2.40, ph$3.30 PB 146 310

Two experiments were conducted to demonstrate directly facilitation and interference effects in selection learning. The selection learning paradigm involves the simultaneous presentation of intentional and incidental items with the requirement that the subject learn only the intentional ones. In experiment 1 an attempt was made to improve the performance of selection learners in acquisition by reducing interference without simultaneously also reducing facilitation. Informative cue selection learners were compared for acquisition rates with uninformative cue selection learners, and the results demonstrated superior acquisition rate for the former. In experiment 2 an attempt was made to reduce acquisition rates of the selection learners by requiring short response latencies. The results showed clear superiority of rote learners over selection learners in acquisition. In retention test some evidence for the differential dissipation of interference effects was obtained. Most forgetting was obtained for rote learners, next for selection learners with uniformative cues, and least for selection learners with informative cues. (Author) (See also PB 146 311)

Research Center for Group Dynamics, U. of Michigan, Ann Arbor.
STUDIES ON DRIVE AND INCENTIVE IN PERCEPTION. I. SOME EFFECTS OF DRIVE ON STIMULUS GENERALIZATION, by Donald Dorfman. Technical rept. no. 5 on Contract AF 49(638)367 and National Sciences Foundation Grant G-4951. Feb 60, 18p. 26 refs. AFOSR-TN-60-326; AD-233 777.
Order from LC mi$2.40, ph$3.30 PB 146 641

Some implications of the hypothesis that the effective or perceived intensity of a stimulus is an increasing function of drive level were tested. Implications were derived for stimulus-generalization data. The experimental results confirmed the hypothesis: (1) an increase in drive level from training to test resulted in a shift of the generalization gradient toward the lesser physical stimulus intensities; and (2) a decrease in drive level from training to test resulted in a shift of the generalization gradient toward the greater physical stimulus intensities.

Rutgers State U., New Brunswick, N. J.
THE SENSITIVITY OF EMPLOYEE ATTITUDE QUESTIONNAIRES, by F. K. Berrien and William H. Angoff. Technical rept. no. 5 on Contract Nonr-404(10). Sep 59, 47p. AD-226 671.
Order from LC mi$3.30, ph$7.80 PB 148 596

Two industrial plants, M and C, under the same management, doing identical work but separated by several hundred miles, were surveyed by an attitude questionnaire on two occasions separated by three and a half months. Just before the second survey in Plant C, employees were informed that the plant would be moved to a distant location in the near future. Interviews with employees, supplementing the questionnaires, confirmed the expectation that attitudes toward the company were adversely affected by the announced plans. However, the adverse attitudes, as expressed on the questionnaire, "scapegoated" supervisors whose behavior had not actually changed as evidenced by other questions. No similar changes occurred in the control plant. Because the majority of the questions did not show important changes in item values between Time 1 and 2, and because the observed changes appeared in far greater number in only one shift of Plant C, it is suggested that questionnaires of this type may be less sensitive than sometimes supposed. The usefulness of such questionnaires as research or management tools in assessing changes less drastic than the one described herein may be questioned. (Author)

Stanford U., Calif.
SOME ATTEMPTS TO MEASURE TOLERANCE FOR DISSONANCE, by Elliot Aronson and Leon Festinger. Technical rept. on Contract AF 41(657)140. Dec 58, 18p. WADC-TR-58-492; AD-207 337.
Order from LC mi$2.40, ph$3.30 PB 149 286

Individuals differ in their ability to tolerate cognitive dissonance introduced in laboratory experiments. The research reported in this paper was an attempt to develop a measure of tolerance for dissonance. Five tests were developed, four of which were administered to the predetermined criterion groups. None of these

effectively discriminated between subjects whose behavior indicated a high tolerance for dissonance from those whose behavior indicated low tolerance for dissonance. A different approach to a criterion was tried by identifying a group that had demonstrated high tolerance in a real-life situation. These were students who had changed majors in their junior year of college. A personality inventory was constructed and administered to ex-engineering majors and to a control group of engineering majors. Substantial differences in responses appeared in six areas. The general effectiveness of the questionnaire as a measure of tolerance for dissonance must be tested by administration to other groups that have recently made an important life decision, such as changing occupation or religion. (Author)

Virginia U., Charlottesville.
STUDIES IN PROBLEM SOLVING, by Frank W. Banghart, Arthur J. Bachrach, and Evan G. Pattishall. Technical rept. on Contract Nonr-474(08). Sep 59, 50p. 17 refs. AD-226 663.
Order from LC mi$3.30, ph$7.80 PB 148 606

Decision-making and problem solving; group structure, anxiety and problem solving efficiency; interaction of group structure and anxiety on problem solving efficiency; and GSR responses during problem solving.

[Washington U., St. Louis, Mo. School of Medicine]
THE EFFECT OF ELECTROCONVULSIVE SHOCK ON MALE ALBINO RATS WITH EXPERIMENTALLY INDUCED SENSORY DEFICITS, by David G. McDonald. Progress rept. on Contract Nonr-816(06). 30 June 59, 26p. AD-225 308.
Order from LC mi$2.70, ph$4.80 PB 146 688

A test was made of the hypothesis that a series of electroconvulsive shocks (ECS) produce an increase in reactivity to a variety of environmental stimuli in the male albino rat. Groups of blind, deaf, and anosmic animals were produced. After allowing sufficient time for recovery, one-half of the animals in each group received a series of 15 ECS, the other half 15 pseudo-ECS, one per day for 15 days. All animals were then trained in an enclosed alley straightaway, one trial per day for 20 days. Data indicated that a series of ECS results in significant differences in behavior, caused by a general increase in reactivity to environmental stimuli. (See also PB 144 182)

Washington U., St. Louis, Mo.
FACTOR ANALYSIS AND RELATED TECHNIQUES IN THE STUDY OF LEARNING. A REPORT OF A CONFERENCE HELD AT WASHINGTON UNIVERSITY, SAINT LOUIS, MISSOURI, 19-20 FEBRUARY 1959, ed. by Philip H. Dubois, Winton H. Manning, and Carl J. Spies. Technical rept. no. 7 on Contract Nonr-816(02). Aug 59, 194p. 96 refs. AD-226 739.
Order from LC mi$8.70, ph$30.30 PB 148 177

Contents:
An analytic approach to factor analysis, Philip H. DuBois
A bibliography of factor analytic studies of learning, Carl J. Spies
The triangular method of factor analysis in learning research, Winton H. Manning
The computation of the inverse of a matrix of correlations: an analytically meaningful approach, Philip H. DuBois and Winton H. Manning
Learning, prediction and the simplex, Lloyd G. Humphreys
Simplex theory in learning and training, Marshall B. Jones
Abilities and the learning of psychomotor skills, Edwin A. Fleishman
Determination of generalized learning curves by factor analysis, Ledyard R. Tucker
Learning and human ability: a theoretical approach, George A. Ferguson

Washington U., Seattle.
DIMENSIONAL ANALYSIS, LATENT STRUCTURE, AND THE PROBLEM OF PATTERNS, by Clifford E. Lunneborg, Jr. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C4). Sep 59, 89p. 31 refs. AD-226 073.
Order from LC mi$4.80, ph$13.80 PB 148 593

A development study is presented of a technique of analysis dependent upon the configural dimensionality of a set of psychological measures. The problem of patterns arises from the criticism of traditional test scoring procedures that linearly combining item or test responses results in a loss of information inherent in the patterning or configuration of the responses. If pattern information is present for a set of measures over a sample of respondents, then, in terms of the general polynomial formulation, the higher order power and product terms should provide sources of variation independent of the variation possessed by the original measures. This proposition was recast in a form suitable to test by techniques conventionally associated with factor analysis. This new proposition was that the rank of a matrix of observations on a set of psychological measures augmented by higher order power and product terms should be greater than the rank of the matrix of observations on the original variables considered by themselves if any pattern information is present in those observations. The present technique and the problem of pattern analysis is compared with the technique of latent class analysis. The latter is shown to be a form of pattern analysis restricted to somewhat homogeneous sets of measures. (Author)

Washington U., Seattle. Div. of Counseling and Testing Services.
A PROCEDURE FOR STANDARDIZING AND IPSATIZING USING THE IBM TYPE 650, by Calvin E. Wright. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C4). June 59, 8p. 7 refs. AD-219 273
Order from LC mi$1.80, ph$1.80 PB 146 412

BIOLOGICAL SCIENCES

Arctic Aeromedical Lab., Ladd AFB, Alaska.
COLD TESTING OF SELECTED COMPONENTS OF ECL-20-92-28-36-BED AIR TRANSPORTABLE INFIRMARY, by Charles L. Lecker. Jan 58, 20p. Technical note AAL-TN-58-31; AD-221 552.
Order from LC mi$2.40, ph$3.30 PB 146 628

Cold testing of selected components from a 36-bed air transportable infirmary was conducted at Ladd Air Force Base, Alaska to determine serviceability and operational capability at sub-zero temperatures. The tests were conducted in a squad tent which was a component of the 36-bed assemblage. During a typical 8 hr test period the tent interior displayed floor temperatures between -22°F. to +24°F. in areas remote from the heat source and temperatures between -12°F. to +62°F. in an area near the heat source. Pre-and post-exposure control tests were conducted indoors at a temperature of approximately 70°F. During the cold testing of items other than the tent, the outside temperatures ranged from -28°F. to 35°F. The tent was erected at a temperature of 10°F. with approximately 8 inches of snow cover. The wind velocity ranged from zero to 2 miles per hour. All components were given a rough treatment test as well. (Author)

Anatomy and Physiology

Air Force Missile Development Center, Holloman AFB, N. Mex.
HUMAN DECELERATION TESTS, by Eli L. Beeding, Jr. and John D. Mosely. Jan 60, 15p. 2 refs. AFMDC-TN-60-2; AD-234 148.
Order from LC mi$2.40, ph$3.30 PB 146 634

A series of deceleration tests were conducted to determine human tolerance to impact forces with the subject seated in the backward facing position. For healthy males seated in the backward facing position, restrained with shoulder straps, lap belt and inverted "V" strap, the tolerance limit to G forces of .04 second duration seems to be in the area of 83 G at 3800 G/second.

Army Chemical Warfare Labs., Army Chemical Center, Md.
BREATHING IN BRIEF EXERCISE, by F. N. Craig and E. G. Cummings. Apr 60, 22p. 13 refs. CWLR-2364.
Order from LC mi$2.70, ph$4.80 PB 148 265

Ventilation of the lungs before, during, and after running on the treadmill for periods of 20 and 60 seconds has been observed in two men. Speed and grade were varied and mixtures of air, oxygen, and carbon dioxide were inhaled. Oxygen consumption, carbon dioxide output, and the concentration of carbon dioxide in respired air were also observed. In the first 20 seconds of the run, the ventilation varied with speed but was not necessarily proportional to the ultimate metabolic cost of the run. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
ESTIMATION OF PULMONARY RESISTANCE BY REPETITIVE INTERRUPTION OF AIR FLOW, by John A. Clements, John T. Sharp and others. Oct 59, 31p. 13 refs. CWL Special pub. 2-24.
Order from LC mi$3.00, ph$6.30 PB 146 345

A simple technique for estimation of lung and airway resistance has been developed, using repetitive interruption of air flow and non-linear flowmetering. The method is satisfactory with respect to reproducibility of values and is a valid method for measuring resistance, as judged by comparison with standard methods. The theory of the method has been briefly explored, with special attention to the influence of the thorax and effect of upper airway properties. The physical properties of the thorax cause slight overestimation of resistance and this effect is increased at the extremes of lung volume. The effect of upper airway properties is to cause underestimation of resistance; this effect is accentuated by increased distensibility of upper airways, especially when pulmonary resistance is high. It is concluded from resistance measurements on human subjects and from studies on respiratory analogs that the inherent error of the method ranges from about +0.2 cm $H_2O/1/sec$ in the normal to about -1.5 cm $H_2O/1/sec$ at 15 cm $H_2O/1/sec$. It is pointed out that the method may develop larger errors in inhomogeneous obstructive pulmonary disease.

Army Medical Research Lab., Fort Knox, Ky.
SOME BEHAVIORAL AND PHYSIOLOGICAL STUDIES IN VIBRATION, by Vernon H. Schaefer, Robert G. Ulmer, and Harry J. Link. 12 June 59, 31p. 23 refs. Rept. no. 389; AD-218 075.
Order from LC mi$3.00, ph$6.30 PB 146 314

Male albino rats subjected to whole body vibration exhibited significant but generally transient decrements in a number of behavioral and physiological measures. Important pathological changes were also found. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
HIGH G PROTECTION, by R. F. Gray and M. G. Webb. Rept. on Proj. TED ADC AE 1411. 12 Feb 60, 22p. 10 refs. Rept. no. 7 on Task MR005.12-0007.2; NADC MA-5910; AD-235 338.
Order from LC mi$2.70, ph$4.80 PB 146 960

The advantages, problems, and limits of older types of G protective systems are discussed in this report. Theories are presented for methods of using liquid or form-fitting external supports for the body along with respiratory pressurization to counteract the distorting forces. Actual devices which were worked out to apply these theories are shown. These devices include: (a) the Mayo Tank first used in 1942 to test G protection by submersion in water; (b) the G-Capsule and associated equipment; and (c) the Moulded Couch incorporating several devices or procedures such as partial supination to avoid chest pain. Through the use of these various devices during the past year, several new records of tolerance to centrifugal acceleration have been established, indications have been gained for improvements on these devices, and it is expected that higher levels of G tolerance will be attained. (Author)

California U., Los Angeles.
A COMPARISON OF THE RECEIVER OPERATING CHARACTERISTICS FOR MESSAGES RECEIVED BY EAR AND BY EYE, by Edward C. Carterette and Michael Cole. Technical rept. no. 2 on Contract Nonr-233(58). 18 June 59, 24p. 15 refs. AD-225 060.
Order from LC mi$2.70, ph$4.80 PB 146 695

The following questions were investigated: (1) are the auditory and visual receiver operating characteristic curves different; and (2) does the assumption of a constant probability of correct recognition over successive presentations hold up as a good engineering approximation for vision? Visual and auditory experiments indicated a remarkable similarity in the form of the response whether the messages were spoken over a noisy communication channel or presented for a brief duration in a tachistoscope.

Copenhagen U. (Denmark).
AN INVESTIGATION OF THE EFFECTS OF CAUDATE PROJECTIONS TO CEREBRAL CORTEX, by A. Mosfeldt Laursen. Final technical rept. for 1 1 Nov 58-31 Oct 59 on Contract DA 91-591-EUC-943. 30 Nov 59, 20p. 20 refs. AD-231 380.
Order from LC mi$2.70, ph$4.80 PB 146 307

The influence on cortical electrical activity exerted by the caudate nucleus was tested and a search was conducted for electrical responses in this nucleus when the cerebral cortex was stimulated electrically. Strong single pulses delivered to the caudate evoked a potential whose source was found to be the caudate nucleus itself, and which could be recorded on the cortical surface. There was no evidence of potentials generated in the cortex when the caudate nucleus was stimulated. The dorsolateral surface of the hemispheres was explored with a stimulating electrode using a wide range of stimulus parameters, while attempts were made to detect an electrical response in the caudate. It was found that the caudate could not be considered a relay for the unspecific thalamic projections to the cortex, and there is consequently no evidence to indicate that the function of the caudate is directly connected with that of the reticular activating system of Moruzzi and Magoun.

Lamont Geological Observatory, Palisades, N. Y.
THE RELATIONSHIP OF REPRODUCTIVE TEMPERATURE AND THE GEOGRAPHICAL RANGE OF THE MARINE WOODBORER LIMNORIA TRIPUNCTATA, by Carolyn Beckman and Robert Menzies. Technical rept. no. 2 on Contract Nonr-266(41). Sep 59, 20p. 8 refs. CU-3-59-Nonr 266(41); AD-228 561.
Order from LC mi$2.70, ph$4.80 PB 148 598

Experimental results show that Limnoria tripunctata will feed at temperatures ranging from approximately 10°C to 30°C. The reproductive temperature range appears to be from about 15°C to 30°C and the greatest population increase is in the neighborhood of 25°C. Excessive mortality results at 30°C. Gravidity and hence number of young produced depends upon the season and does not appear to be immediately modified by the presence of favorable reproductive temperatures. The experimental results agree well with the known geographic range of the species. (Author)

Lovelace Foundation, Albuquerque, N. Mex.
THE ELUCIDATION OF THE ROLE PLAYED BY THE CENTRAL AND PERIPHERAL TEMPERATURES AT THE INITIATION OF SHIVERING, by Thomas P. K. Lim. Rept. on Contract AF 41(657)200. Aug 58, 14p. 19 refs. Technical note AAL-TN-58-26.
Order from LC mi$2.40, ph$3.30 PB 146 629

The purpose of this study was to elucidate the controlling mechanisms of central (brain) and peripheral (subcutaneous) temperatures at the onset of shivering in anesthetized dogs during induced hypothermia. The related problems concerning the effect of shivering activities on metabolic and respiratory functions will also be investigated at a later date. (Author)

Navy Experimental Diving Unit, Naval Weapons Plant, Washington, D. C.
THE DEVELOPMENT OF A TEST TO DETERMINE THE ADEQUACY OF DECOMPRESSION FOLLOWING A DIVE, by R. J. Kiessling and G. J. Duffner. 15 Feb 60, 23p. 16 refs. Research rept. 2-60; AD-234 889.
Order from LC mi$2.70, ph$4.80 PB 146 958

An attempt was made to develop a test of decompression adequacy which can be used both as a research technique and to evaluate new decompression procedures and devices for diver and underwater swimmer. Eighteen subjects made 30-min air dives of 90, 110, and 125 ft. After a surface interval of 45 min the divers were further decompressed to 18,000 ft of altitude for 1 hr. Times of occurrence of decompression sickness symptoms were utilized as measurements of decompression adequacy. The test devised proved to predict decompression adequacy following no-decompression dives. (Author)

North Dakota U., Grand Forks.
CHANGES IN BODY TEMPERATURE AND RENAL FUNCTION IN DOGS EXPOSED TO COLD, by W. C. Nungesser and H. E. Ederstrom. Rept. on Contract AF 18(600)1136. Nov 57, 35p. 8 refs. Technical note AAL-TN-57-38; AD-221 548.
Order from LC mi$3.00, ph$6.30 PB 146 619

Methods for the study of renal function in the dog in cold, and to correlate any observed changes with other physiological variables known to occur in cold were investigated. Methods employed are described. Subsequent experiments duplicating the coldroom experiments but without cold were run on the same animals. Changes in renal functions studied were variable in the unanesthetized dog in the cold. No changes were seen which were different in magnitude or direction than might occur with time alone. Changes in skin temperatures, shivering, and other variables in these and previous experiments are discussed.

Technische Hochschule, Munich (West Germany).
INVESTIGATION OF THE POSSIBLE INFLUENCE OF ATMOSPHERIC IONS ON HUMAN REACTION TIME, by Joseph Eichmeier and John Rheinstein. Final technical rept. for 1 Jan-31 Dec 59 on Contract DA 91-591-EUC-1035. [1959] 52p. 173 refs. AD-232 720.
Order from LC mi$3.60, ph$9.30 PB 146 309

Ions must be breathed in through the mouth in order to affect human push button reaction time. Different concentrations of atmospheric ions have different effects upon reaction time. Concentrations within an order of magnitude of those found in nature are

found to have an effect on the reaction time. It is improbable that the electric field of an ion generator has any large effect on reaction time. The possibilities of the elimination of atmospheric small ions in a sealed room are examined. The most appropriate electrical means of making a sealed room free of ions is by using 2 opposite walls of the room as electrodes of a condenser. The applied field should be of the order of 30 V/cm. Ion densities as low as 50 positive and 100 negative ions/cm^3 have been obtained in a wire cage. Methods are discussed for reducing the influence of the undesirable part of the electric field of the measuring condenser.

Tufts U. School of Medicine, Boston, Mass.
METABOLISM OF FATTY ACIDS AND RELATED SUBSTANCES IN ANIMALS EXPOSED TO COLD, by David Rapport. Rept. for 1 Nov 58-31 Jan 59 on Contract AF 41(657)145. June 59, 17p. 2 refs. Technical note AAL-TN-59-16; AD-233 846.
Order from LC mi$2.40, ph$3.30 PB 146 660

Contents:
Methods
Mitochondrial dry weight
Liver perfusion method
Protein content of liver homogenate
Isolation of fatty acids from liver homogenates
Results
Further studies on cold exposure and oxidative phosphorylation
The adrenal medulla and oxidative phosphorylation
Oxidative phosphorylation in mitochondria of the cold-fasted rat
Acetate oxidation by mitochondria from control and cold-fasted liver
Fatty acid synthesis in the cell-free liver system

Virginia U. Medical School, Charlottesville.
GROSS BODY COMPOSITION IN ALASKAN AND TEMPERATE ZONE MAMMALS, by Grover C. Pitts. Progress rept. for 1 Mar-31 May 58, on Contract AF 41(657)186. June 58, 9p. 2 refs. Technical note AAL-TN-58-8; AD-230 838.
Order from LC mi$1.80, ph$1.80 PB 146 467

Approximately 140 mammals of 31 species, 25 genera, and 13 families, including forms indigenous to both Alaska and Virginia, were collected, dissected into 11 gross components, and the fresh weight, fraction of fat, and fraction of water determined on each component. The difference between fatness of Alaskan and Virginia specimens was significant. Fatness was correlated with specific gravity of the carcass and presented in graphic form.

Biochemistry

Florida State U., Tallahassee.
SPECIFIC ANTAGONISTS OF BIOLOGICALLY ACTIVE COMPOUNDS, by Karl Dittmer. Final rept. for 15 May 55-30 Sep 58 on Contract Nonr-1753(00). [1958] 15p. 31 refs. AD-225 278.
Order from LC mi$2.40, ph$3.30 PB 148 57[illegible]

Contents:
The toxicity of β-2-furylalanine in the growint rat.
The toxicity of γ-chloro- and γ-bromallylglycine in the rat.
Microbiological properties of proparoyl-S-cysteine
Microbiological properties of some derivatives of amino acid anhydrides
Present status of studies regarding the mechanism of amino acid antagonism.
Synthesis and properties of trifluoroacetamidomalonate.
Synthesis and properties of α-keto and α-hydroxy derivatives of some amino acid antagonists.
Synthesis and microbiological properties of α-keto and α-hydroxy derivatives of some amino acid antagonists.

Milan U. (Italy).
CELLULAR DAMAGE PRODUCED BY HYPOXIA, by Enrico Ciaranfi. Technical final rept. on Contract AF 61(514)1026. 30 Oct 59, 9p. 9 refs. AFOSR-TR-60-42. AD-234 214.
Order from LC mi$1.80, ph$1.80 PB 146 622

The consequences of hypoxia have been studied on rat liver cells, by the aid of electron microscopy and by different biochemical techniques, and were extended to the influence of hypoxia on the metabolism of brain cortex.

School of Aviation Medicine, Brooks AFB, Tex.
THE AUTOMATIC DETERMINATION OF CALCIUM, INORGANIC PHOSPHATE, UREA NITROGEN, AND GLUCOSE IN PAROTID FLUID, by Ira L. Shannon and John R. Prigmore. Apr 60, 17p. 49 refs. Rept. 60-49.
Order from LC mi$2.40, ph$3.30 PB 148 084

Automatic methods of chemical analysis have been adapted to parotid fluid analysis and the performance of these procedures has been evaluated in the determination of calcium, inorganic phosphate, urea nitrogen, and glucose.

School of Aviation Medicine, Brooks AFB, Tex.
PAROTID GLAND FLOW RATE AND PAROTID FLUID UREA CONCENTRATION, by Ira L. Shannon and John R. Prigmore. June 60, 7p. 7 refs. Rept. no. 60-59.
Order from LC mi$1.80, ph$1.80 PB 148 498

In a series of three experiments the relationship between parotid gland flow rate and parotid fluid urea concentration was determined. In each instance a significant ($P < .01$) negative correlation was found between these two variables. The data were all combined and an average within-subjects correlation coefficient of - 83 ($P < .01$) was calculated. The average between-subjects correlation coefficient of .05 was not significantly different from zero. In a fourth experiment parotid flow was elicited continuously for three hours in 11 subjects. The effect of time on flow rate and urea concentration was insignificant; that is, there was no apparent gland fatigue effect on either variable during the three-hour period. (Author)

Tufts U. School of Medicine, Boston, Mass.
OXIDATIVE PHOSPHORYLATION IN LIVER MITOCHONDRIA PREPARED FROM COLD-EXPOSED RATS, by Sylvia Panagos, Robert E. Beyer, and Edward J. Masoro. Rept. on Contract AF 41(657)145. June 58, 5p. 4 refs. Technical note AAL-TN-58-32; AD-221 553.
Order from LC mi$1.80, ph$1.80 PB 146 627

The mechanism of increased heat production in animals exposed to cold for 2 or more wk was explained in the following manner: On a decrease in the formation of ATP coupled to electron transport, a larger proportion of the available energy derived directly from this system would be evolved as heat. This increased heat production may in part contribute to the maintenance of body temperature in the cold environment. The necessity of the thyroid and adrenal secretions for continued survival in the cold may indicate an hormonal influence on these energy-producing reactions of the body.
(Biological Sciences--Biochemistry, 14 Oct 60)

Pathology

Institut Pasteur, Paris (France).
BIOPHYSICAL AND BIOCHEMICAL STUDIES ON VIRUS INFECTED CELLS, by Pierre Lepine. Final technical rept. no. 1, 1 Mar 59-29 Feb 60, on Contract DA 91-591-EUC-1069. 29 Feb 60, 15p. 7 refs. AD-234 913.
Order from LC mi$2.40, ph$3.30 PB 146 955

Preliminary infection of a given mammalian cell system, by a virus whose virulence is maintained at such a low grade that it will not destroy the infected cells but simply cause a chronic infection, is capable of completely suppressing the multiplication of another virus, though highly virulent, when added as a secondary infecting agent in the given cell system, notwithstanding the fact that there is no antigen relation or cross-immunity between the two viruses involved in the process. This inhibition phenomenon bears on the phase of multiplication of the second infecting virus, this virus being fixed by the preliminary infected cells in the same amount and in the same conditions as it is fixed on normal control cells. This inhibitory phenomenon is governed by the production of a substance of a protein nature in the infected cells which is capable of inhibiting the growth of the virus and which can be transferred from an infected system to a non infected one, thus inducing in normal non infected cells an acquired resistance to virus infection. The study of syncytial formations under the influence of a Myxovirus in chronically infected cell systems lead to the conclusion that such formations are governed by the presence of a cell secreted substance which was named syncytin and which induces the formation of such syncytia by dissolving the limiting membrane in infected cell aggregates. (Author)

Institute of Neurology [National Hospital, London (Gt. Brit.)]
SUBCORTICAL PARTICIPATION IN THE DEVELOPMENT OF MIRROR FOCI. Final technical status rept. no. 4, 1 Oct-30 Dec 59, on Contract DA 91-591-EUC-1021. 21 Dec 59, 6p. 3 refs. AD-232 722.
Order from LC mi$1.80, ph$1.80 PB 146 308

The effect of the synchronous discharge of a large population of cortico-thalamic neurones on activity within the thalamic somato-sensory relay nuclei has been studied. Thalamic responses to peripheral nerve stimulation are depressed by activity within cortico-thalamic neurones. A subconvulsive dose of strychnine given intravenously changes this depression to enchancement. (Author)

Johns Hopkins U. School of Hygiene and Public Health. Baltimore, Md.
VIRULENCE OF ROCKY MOUNTAIN SPOTTED FEVER, by Winston H. Price. Final progress rept. on Contract Nonr-248(44). 30 June 58, 41p. 8 refs.
Order from LC mi$3.30, ph$7.80 PB 148 928

Three virulent types of R. rickettsii exist in the United States, which can be differentiated by the symptoms they produce in guinea pigs. In their arthropod vector, D andersoni, each type may assume an intermediate virulent phase, lower in virulence than the virulent type from which it arose. All three virulent types can pass into an avirulent phase, which is of much lower virulence than the intermediate virulent phase. The two low virulent phases are not genotypic changes, but are only changes in phenotype. A substance can be shown to be present in appropriately prepared tick suspensions which lowers the virulence of the virulent phase when incubated with such rickettsiae in vitro. The virulence of both phases can be increased by diphosphopyridine nucleotide (DPN) or by appropriately prepared tick extracts. The avirulent phase is characterized by being virulent for chick embryos but not for guinea pigs; it immunizes guinea pigs against the virulent phase of any one of the three types, but not against boutonneuse fever, and can not be recovered from guinea pigs. In vitro reactivation experiments indicate that the increase in virulence from the avirulent phase to the virulent phase occurs in two and possibly 3 steps, although the same compounds appear to be involved in each reactivation step. All data indicate that the changes of R. rickettsii from high to low virulence phases to avirulent phases and back to high virulence are not due to selection, mutation, or a combination of these phenomena but to actual changes in the majority of the rickettsiae. The low virulent phases have so far only been produced in arthropod vectors or in vitro by the addition of tick extracts. Two very low virulent types of R. rickettsii, U_1 and U_2, exist in the United States. All data fits with the theory that the arthropod can control the virulence of R. Rickettsiae by controlling the synthesis of specific compounds. Although the avirulent phase of all virulent types can be readily isolated in nature, there is no evidence that these changes in virulence play a role in selecting new types of virulent strains in nature.

[Vienna U. (Austria)].
INVESTIGATIONS ON SPRING-SUMMER-MENINGO-ENCEPHALITIS IN THE EASTERN PART OF AUSTRIA, by Richard Bieling. Final technical rept. for 1 Feb 59-31 Jan 60 on Contract DA 91-591-EUC-1061. [1960] 15p. AD-234 397.
Order from LC mi$2.40, ph$3.30 PB 146 956

Systematic virological-serological examinations with patients of the hospital at Neunkirchen resulted in the finding that there is a certain causal connexion

to FSME-virus with 5 cases, while with 7 cases this result was uncertain. The results show that Enteroviruses are of less importance, as in most of the cases FSME was proved. It is not possible to conclude on the mode of infection out of these few numbers.

Pharmacology and Toxicology

Army Chemical Warfare Labs., Army Chemical Center, Md.
CONTINUOUS EXPOSURE OF LABORATORY ANIMALS TO A LOW CONCENTRATION OF CARBON MONOXIDE, by Nelson P. Musselman, William A. Groff and others. Jan 60, 11p. 23 refs. CWLR-2337; AD-232 115.
Order from LC mi$2.40, ph$3.30 PB 146 302

The effects on dogs, rabbits, and rats of continuous exposure (24 hr a day, 7 days a wk) to a low concentration (50 ppm) of carbon monoxide (CO) was studied. Three weeks after initial exposure, the hemoglobin, hematocrit, and red blood cell (RBC) counts of the dogs showed slight increases, which persisted throughout the remainder of the tests. The average per cent saturation of hemoglobin by CO was 7.3 for dogs 3.2 for rabbits, and 1.8 for rats. Except for a small increase in the eosinophil count of the rats, no other blood changes were found. All tissues examined microscopically and macroscopically appeared similar to those of the controls. The exposed animals showed no significant differences as compared with the control animals in voluntary activity, behavior, body weight, ratio of heart weight to body weight, and electrocardiograms (EKG). The absence of toxic signs and only slight blood changes in the dogs, rabbits, and rats used in the experiments indicate that no harmful effects result fron continuous exposure of these animals to a concentration of 50 ppm of CO. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
STAFF CONFERENCE REPORT: HEALTH HAZARDS OF MILITARY CHEMICALS, by Keith H. Jacobson. Oct 59, 30p. 5 refs. CWL Special pub. 2-25; AD-228 583.
Order from LC mi$2.70, ph$4.80 PB 146 460

Contents:
Pharmacological studies on borane fuels
Biochemical studies on borane fuels
Acute and subacute toxicity of HEF-2 vapor
Acute and subacute toxicity of HEF-3
Skin decontamination of borane fuels
Toxicity of boron oxide aerosols
Perchloryl fluoride toxicity
Blood chemistry studies and fluoride metabolsim of animals exposed to perchloryl fluoride
Histo-pathologic changes produced by single and repeated exposures of dogs and rodents to perchloryl fluoride (See also PB 135 244)

Columbia U. Coll. of Physicians and Surgeons, New York.
CHEMICAL FACTORS AFFECTING THE PHYSIOLOGY AND PATHOLOGY OF NERVOUS FUNCTION, by David Nachmansohn. Final rept. Aug 54-Aug 58, on Contract DA 49-007-MD-740. Apr 58, 10p. 24 24 refs. AD-218 028.
Order from LC mi$1.80, ph$1.80 PB 148 383

Development of an antidote against nerve gas poisoning: Experiments are described in which 2-pyridine aldoxime methiodide (2-PAM) was successfully used on mice to prevent paraoxan poisoning and on human beings to treat patients poisoned with parathion, an insecticide. 2-PAM was considered a really efficient antidote. Atropine combined with PAM protected animals against 15- to 20-fold lethal doses (and more) of alkylphosphate. The combination proved even sucessful against poisoning with sarin. 2-PAM was found to exert the extraordinary power of reactivation only in the case of phosphorylated acetylcholinesterase.
Lipid soluble quaternary ammonium ions: The action of lipid soluble quaternary ammonium ions in the conducting membrane is discussed. Many possibilities for the study of the chemical mechanism underlying nerve activity are offered by modifying molecules in such a way that they produce predictable and desired effects.

Sperling Labs., Arlington, Va.
DIPROPARGYL ETHER: LD_{50} - DOGS; LD_{50} - RABBITS; 1,6 HEPTADIYNE: LD_{50} - DOGS, LD_{50} - RABBITS. Rept, on Contract Nonr-2727(00). [1959] 24p. AD-227 813.
Order from LC mi$2.70, ph$4.80 PB 148 587

Tabulated results

Radiobiology

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
A COMPUTER SOLUTION FOR DETERMINATION OF THERMAL TISSUE DAMAGE INTEGRALS FROM EXPERIMENTAL DATA, by Alice M. Stoll. 9 Mar 60, 16p. 5 refs. Rept. no. 17 on Task MR 005.15-2002.1; NADC MA-6004; AD-234 709.
Order from LC mi$2.40, ph$3.30 PB 146 959

A computer method utilizing the IBM 650 and the Bell Telephone programming system was developed for the evaluation of tissue damage due to thermal irradiation. It is presented as an illustration of the possibilities computers offer the biological investigator unversed in their use. It was possible to obtain a complete analysis, yielding separate values of damage during heating, damage during cooling, and total damage, within 45 sec or less, of machine time for each set of data. In contrast, graphical integration by a skilled operator required at least a half-hour for each set. Since hundreds of such analyses may be required in this type of study, the advantages of computer use are obvious. Furthermore, the relative simplicity of the programming system is such that very little training or mathematical skill is required for the biological investigator to be able to prepare his own computer programs and thereby eliminate many tedious and time-consuming graphical procedures. (Author)

California U., Berkeley.
PROCEEDINGS OF ANNUAL TRI-SERVICE CONFERENCE [NO. 3] ON BIOLOGICAL EFFECTS OF MICROWAVE RADIATING EQUIPMENTS, 25-27 25-27 AUGUST, 1959. Aug 59, 342p. 63 refs. RADC-TR-59-140; AD-234 788.
Order from LC mi$11.10, ph$53.10 PB 146 531

See also PB 140 093

Chicago U., Ill.
EFFECT OF X-IRRADIATION ON SPLEEN NUCLEOTIDE LEVELS, by Edwin M. Uyeki. Apr 60, 11p. 10 refs. AFSAM rept. 60-28.
Order from LC mi$2.40, ph$3.30 PB 148 083

A study was made of the effects of whole-body x-irradiation on the adenosine nucleotide levels of the spleens of rats, mice, and guinea pigs. At various intervals after the animals were exposed to 400 and 800 r of x-ray, they were sacrificed and measurements taken of the adenosine triphosphate, adenosine diphosphate, and adenylic acid levels. A lethal dose of x-ray (800 r) caused a decrease in the ATP levels of rat spleen to 63 percent below normal and a reduction in the total nucleotide content of the spleen. A 50 percent decrease in the adenosine triphosphate levels of the spleens of mice was observed with 400 r of x-ray and after 800 r a progressive and continuous decline in this nucleotide occurred during the survival period. The adenosine triphosphate levels of guinea pig spleens decreased more slowly and to a lesser extent than such levels in the spleens of rats and mice. The radiation-induced decreases in adenosine triphosphate content of the spleens of these three species may be explainable on the basis of an increased adenosine triphosphatase activity which was previously observed in this laboratory to be caused by ionizing radiations. The nature of the biologic test system (viz, growing cells) restricts a causal association between the nucleotide titers and phosphatase activity. (Author)

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
MOLECULAR RESPONSE CHARACTERISTICS TO ULTRA-HIGH FREQUENCY FIELDS, by Herman P. Schwan. Technical rept. no. 24 on [Contract Nonr-551(05)] [1959] 26p.
Order from LC mi$2.70, ph$4.80 PB 148 160

It is concluded from available information that effects of orientation may definitely exist at levels of organization down to about one micron, and breakage of molecular bonds may occur under pulsed conditions involving high field values and at the lower end of the radar frequency range.

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
SURVEY OF MICROWAVE ABSORPTION CHARACTERISTICS OF BODY TISSUES, by Herman P. Schwan. Technical rept. no. 25 on Contract [Nonr-551(05)]. [1959] 33p
Order from LC mi$3.00, ph$6.30 PB 148 161

The absorption data reviewed cover a total range of about 1 to 10 at any particular frequency. The determination of absorption characteristics is a prerequisite to much experimental work. For most tissues frequencies substantially higher than 3,000 Mc cause mere surface heating, i.e. they act like infrared or sunlight. At lower frequencies, particularly below 1,000 Mc, much larger penetration is achieved. From the complexity of reflectance and energy distribution it is concluded that no dose meter can be constructed which can be carried on or near the body surface and give sensible data. Standing wave pattern in the body makes it senseless to talk about energy flux in the body and to use it as a measure of dosage.

Public Health Service, Washington, D. C.
RADIOLOGICAL HEALTH DATA. VOLUME I, NO. 3. Monthly rept. June 60, 32p. 53 refs.
Order from OTS $0.50, $3.00/6 mos. PB 161 371-3

Contents:
Milk
Air
Water
Other data: external gamma activity measurements.
(See also PB 161 371-2)

Public Health Service, Washington, D. C.
RADIOLOGICAL HEALTH DATA. VOLUME I, NO. 4. Quarterly rept. July 60, 112p. 5 refs.
Order from OTS $0.50; $3.00/6 mos. PB 161 371-4

Contents:
Radiation protection criteria
Milk
Air
Water
Other data: human bone; food; fish; soils; external gamma; atomic power station
(See also PB 161 371-3)

Public Health Service, Washington, D. C.
RADIOLOGICAL HEALTH DATA. VOLUME I, NO. 5. Aug 60, 50p. 5 refs.
Order from OTS $0.50, $3.00/6 mos PB 161 371-5

Contents:
Sect. 1. Milk
Sect. 2. Air
Sect. 3. Water
Sect. 4. Other data: external gamma; medicine; soils; food; state activities; short lived isotopes
(See also PB 161 371-4)

Radiobiological Lab., U. of Texas, Austin.
RADIOPROTECTION OF FEMALE RATS WITH AET, by George S. Melville, Jr. and Thomas P. Leffingwell. May 60, 14p. 19 refs. AFSAM rept. no. 60-40.
Order from LC mi$2.40, ph$3.30 PB 148 497

The protective effect of S, 2-aminoethylisothiuronium dibromide (AET) against the injury caused by gamma rays has been studied in the female rat. Significant protection has been achieved using either intraperito-

neal injection or gavage. The drug was somewhat more effective when given by the parenteral rather than by the oral route. It was also noted that as the dose rate was decreased from approximately 1,000 to 500 to 100 r per minute, the protective effect of oral treatment with AET was also decreased. Further evidence suggests that larger animals are more susceptible to the toxic effects of the protective drug itself. (Author)

School of Aviation Medicine, Brooks AFB, Tex.
NEUTRON ACTIVATION OF BIOLOGIC MATERIALS: NEUTRON EXPOSURE FACILITY, by David R. Rovner. Feb 60, 9p. 10 refs. Rept. 60-18.
Order from LC mi$1.80, ph$1.80 PB 148 082

A facility for exposing biologic materials to neutrons of varying energies is described. The primary source is a linear accelerator which utilizes: (1) a 100 kv. potential to accelerate deuterium ions; and (2) targets consisting of both deuterium and tritium types. Calibration of the monitoring equipment and operating controls is discussed. The dosimetry of the neutron field is explained and doses at various points are calculated. The maximum flux available is 1.0×10^9 neutrons per second, representing a dose of 93 rep per hour at 4.5 cm. from the target. Measures for radiation safety are briefly described: these are in accord with the recommendations of the National Committee on Radiation Protection. (Author)

Sloan-Kettering Inst. for Cancer Research, New New York.
STUDY OF THE POST-IRRADIATION SYNDROME IN HUMANS, by James J. Nickson. Final rept. for 1 Nov 57-31 Oct 58 on Contract DA 49-007-MD-910. [1958] 26p. AD-211 306.
Order from LC mi$2.70, ph$4.80 PB 146 593

Four patients with nearly normal physiologic condition received five courses of total-body irradiation of calculated absorbed doses from 50 to 150 r at midplane, and one of the patients also received internal irradiation from sodium-24. Physiological alterations resulting from irradiation were studied. Alterations in the formed elements of the circulating blood were found to be the most consistent index of radiation effect. Data are included on changes in creatin-creatinine excretion ratios, pentose excretion rate, and properdin levels.

Southwest Research Inst., San Antonio, Tex.
A PRELIMINARY INVESTIGATION OF THE APPLICATIONS OF MAGNETIC RESONANCE ABSORPTION SPECTROSCOPY TO THE STUDY OF THE EFFECTS OF MICROWAVES ON BIOLOGICAL MATERIALS, by George Pish, William H. Storey, Jr. and others. Rept. no. 12 (Final) for 9 May 58-1 May 59 on Contract AF 30(602)1843. 1 May 59, 95p. 9 refs. RADC-TR-59-81; AD-216 431.
Order from LC mi$5.40, ph$15.30 PB 147 024

Electron spin resonance (EPR) methods were found applicable to show changes induced by microwave radiation upon the eyes of rabbits. The EPR signals obtained from ionizing radiation induced free electrons in the posterior cortex tissue of the lens show a simple singlet structure with the differences between normal and opaque lenses giving a doublet structure. Also, observation of dilute solutions of lens tissue shows the effects of microwave damage. The free radicals induced in lenses exposed to microwave radiation have a longer life than those from normal lenses. Differences in protein structure between normal rabbit eye lenses and rabbit eye lenses in which cataracts have been induced by microwave irradiation were investigated by high resolution nuclear spin resonance (NSR). NSR spectra from the proteins in rabbit eye lenses are shown and are grossly interpreted. Differences in the NSR spectra between some of the cataract-bearing lenses and their non-cataract controls are pointed out, and the meanings of the differences are suggested. The effects of the presence of moisture on the action of trifluoroacetic acid on proteins is considered as a possible explanation for the time dependence of the data. In addition, a table is given showing the dry weights of the samples, together with weight loss upon drying.

Stockholm U. (Sweden).
RESEARCH ON "LOCALIZED RADIO-LESIONS". PART IV. LABORATORY OBSERVATIONS ON THE REPRODUCTIVE BEHAVIOR OF THE PIGEON (COLUMBA LIVIA) DURING THE PRE-INCUBATORY PHASE OF THE BREEDING CYCLE, by Eric Fabricius and Ann-Mari Jansson. Technical rept. no. 1, Appendix 2, on Contract AF 61(514)1247. 1 Mar 59, 33p. 16 refs. AFOSR-TN-60-253; AD-233 373.
Order from LC mi$3.00, ph$6.30 PB 146 313

Contents:
Description of the actions belonging to the reproductive behavior which occur during the pre-incubatory phase
The main reproductive behavior patterns and their frequency during the successive subperiods of the pre-incubatory phase
Bowing, attacking, and driving
Behavior associated with the nest site and the nest
Behavior associated with copulation
The mutual relations of the different actions, and the sequence of their occurrence during the individual 34 min periods
The relations of some behavior items to copulation
The sequence of the behavior items during the individual 34 min tests
The order of the activities
(See also PB 146 305)

Stockholm U. (Sweden).
RESEARCH ON LOCALIZED RADIO-LESIONS. PART V. OBSERVATIONS ON PIGEONS DECEREBRATED WITH HIGH ENERGY PROTONS, by Eric Fabricius and Börje Larsson (U. of Uppsala). Technical rept. no. 1, Appendix 3, on Contract AF 61(514)1247. 26p. 35 refs. AFOSR-TN-60-254; AD-233 374.
Order from LC mi$2.70, ph$4.80 PB 146 312

Four pigeons were decerebrated by radiolesions produced by 185 Mev protons from a synchrocyclotron. The cerebral preduncles were cut off at the level of the anterior commissure and the bending point of the

tractus septo-mesencephalicus. Escape response and spontaneous feeding and drinking disappeared in all the birds, as well as all social behavior, including calling, but the ability of walking, standing in a normal position, and maintaining the equilibrium remained. All birds lost the ability of passing food from the crop into the stomach. The method of producing lesions by a proton beam proved promising for functional studies on the bird brain. The lesions were distinctly restricted. No damage to surroundings structures, and no conditions of shock were observed. (Author) (See also PB 146 313)

Zoology

Arctic Aeromedical Lab., Ladd AFB, Alaska.
SIGNIFICANCE OF ECHINOCOCCUS MULTILOCULARIS TO MILITARY PERSONNEL AT REMOTE STATIONS IN ALASKA, by Jack D. Douglas. June 59, 10p. 10 refs. Technical note AAL-TN-59-3; AD-233 844.
Order from LC mi$1.80, ph$1.80 PB 146 626

Results of this project and other studies which have been conducted in recent years indicate that no medical or surgical problem exists relative to hydatid disease in military personnel stationed on St. Lawrence Island and the coast of Alaska. The problem of prime importance, insofar as military personnel are concerned, is of a psychological nature. Early exploratory work and findings in the native population have given rise to considerable local concern which is transmitted to new arrivals, usually in a manner which is completely out of proportion to the true picture. This laboratory is presently compiling a resume of the recent findings on hydatid disease in Alaska, which will be disseminated to site personnel to help alleviate the psychological problem. Although a true medical or surgical problem does not exist at present, it remains a potential threat, and studies must be continued to clarify further the various aspects of hydatid disease in order that more concrete information relative to control, early detection, and treatment will be available should the problem arise. (Author)

Florida U., Gainesville.
CHAETOGNATHA FROM THE COASTAL WATERS OF THE SOUTHEASTERN ATLANTIC STATES AND THEIR VALUE AS INDICATOR ORGANISMS, by E. Lowe Pierce and Marvin L. Wass. Final rept. on Contract Nonr-580(05). June 59, 63p. 26 refs.
Order from LC mi$3.90, ph$10.80 PB 147 447

The Chaetognatha were studied in plankton samples collected during nine cruises of the Fish and Wildlife Service M/V T. N. Gill in the waters off the coast of the southeastern Atlantic States. Three genera and 12 species were identified in a total of 590 samples examined. Two kinds of water were present in the area, Carolinian Coastal water and Florida Current water. Although most species showed a gradation from one kind of water to the other it was possible to select a species (S. hispida) which had a high percentage of incidence in Carolinian type water. Its presence in the Florida Current would indicate mixing with inshore water. S. hexaptera, S. lyra and K. subtilis showed more than a 90% occurrence in Florida Current water. Their presence in Carolinian type water could be attributed to recent mixing with Florida Current water. Constant selection for the ability to withstand mixed water in this area undoubtedly accounts for the widespread distribution of several of the species collected.

Kansas U., Lawrence.
STUDIES IN GENE-ENVIRONMENT INTERACTIONS IN DDT-RESISTANCE AND RELATED CHARACTERS, II. A CONTRIBUTION TO THE STUDY AND CONTROL OF ENVIRONMENTALLY CAUSED FLUCTUATIONS OF SOME QUANTITATIVE CHARACTERS IN DROSOPHILA MELANGASTER, MEIGEN, by Robert R. Sokal and Heinz W. Neunes. Final rept. on Gene-Environment Interactions in DDT-Resistance and Related Characters, Contract Nonr-583(08). 30 Sep 59, 30p. 13 refs. AD-233 100.
Order from LC mi$2.70, ph$4.80 PB 148 571

Environmentally caused fluctuations in the length of the larval period from generation to generation, as have been observed by several authors in selection experiments with Drosophila melanogaster, were shown to be mainly an effect of uncontrollable difference among separate batches of medium. The length of the pupal period is not subject to these fluctuations. The original hypothesis that the fluctuations in larval period are due to variations of the microflora in the medium vials, could not be verified: rearing the flies aseptically did not reduce the fluctuations. Instead, changes in the chemical composition of Karo-syrup and molasses in our medium were demonstrated to be largely responsible for the fluctuations. By means of replacing these two components with sugar and salts, the fluctuations were satisfactorily reduced. (Author)

Kansas U., Lawrence.
A SURVEY OF THE MOSQUITOES OF THE VICINITY OF KOTZEBUE, ALASKA, by A. Ralph Barr and P. R. Ehrlich. Rept. on Contract AF 41(651)92. May 57, 16p. Technical note AAL-TN-57-9.
Order from LC mi$2.40, ph$3.30 PB 146 620

This report gives the results of a brief survey carried out at Kotzebue and a number of other localities on the shores of the Chukchi Sea during the summer of 1956.

CHEMISTRY

Analytical Chemistry

Army Chemical Warfare Labs., Army Chemical Center, Md.
METHODS OF MICROANALYSIS. III. GRAVIMETRIC DETERMINATIONS OF SULFUR, PHOSPHORUS, BROMINE AND CHLORINE IN ORGANIC COMPOUNDS, by John M. Corliss, Cecil A. Rush and others. Apr 60, 25p. 13 refs. CWLR 2369.
Order from OTS $0.75 PB 161 860

Elementary microgravimetric methods are presented and discussed. Results of their application to the chemical analysis of a variety of standard compounds and products produced in Chemical Corps research projects are tabulated. Some factors concerning the use of the microbalance in obtaining accurate precipitate weights are considered. (Author)

Pennsalt Chemicals Corp., Wyndmoor, Pa.
PROPERTIES AND THERMAL STABILITY OF POLYMERIC MONOAMMINEDICHLOROZINC (II), by Joseph Simkin and B. P. Block. Technical rept. no. 2 on Contract Nonr-2687(00). 1 Aug 59, 6p. 10 refs.
AD-225 086.
Order from LC mi$1.80, ph$1.80 PB 148 132

Monoamminedichlorozinc (I) was prepared by heating $[Zn(NH_3)_2Cl_2]$ at 200°C to release NH_3. The NH_3 loss was rapid at first but gradually decreased to a constant rate, corresponding to a loss of 1 mole NH_3 per $ZnCl_2$. Analysis of the residue confirmed the empirical formula as $An(NH_3)Cl_2$. The product was an amber-colored, transparent, glassy solid at room temperature. It had no sharp melting point, but softened at 80° to 90°C and was transformed into syrup which remained viscous up to 110°C, and became very mobile at 200°C. I was insoluble in common organic solvents but formed clear solutions in dimethylformamide, aqueous NH_3, and mineral acids. Infrared spectra indicated the presence of absorption bands in the region of 1600 and 1300 cm^{-1}. X-ray examination showed the product to be amorphous. These properties indicated the polymeric molecular structure $(-Zn(NH_3)(Cl)Cl-)_x$, with x large in value. I was stored at 200° ± 5°C for 200 hr in air. There was an approximate weight loss of 0.3% per hr for the first 30 hr followed by a significant leveling off to about 0.03 wt -% per hr. Analysis of the residue showed that 0.1% NH_3 remained; the Zn content was unchanged; and there was a substantial drop in total chloride. These results showed that contrary to the literature (R. J. Kane, Ann. chim. et phys [2] 72:29, 1839), I is decomposed upon heating, the dominant reaction being: $2n(NH_3)Cl_2 \Delta 2nCl_2 + NH_3$. The NH_3 which was coordinated with $ZnCl_2$ in I exhibited only moderate resistance toward thermal removal.

Pennsalt Chemicals Corp., Wyndmoor, Pa.
THE REACTION OF HEXAMMINECOBALT (III) CHLORIDE WITH SODIUM CYANIDE, by B. P. Block. Technical rept. no. 4 on Contract Nonr-2687(00). 1 Aug 59, 4p. 3 refs. AD-225 088.
Order from LC mi$1.80, ph$1.80 PB 148 134

Hexamminecobalt (III) chloride was allowed to react with NaCN at 80°C to produce a precipitate of $[Co(NH_3)_6]$ $[Co(CN)_6]$ rather than $[Co(NH_3)(CN)_3]$. It was concluded that partially substituted cyanocobalt (III) ammines are more reactive toward substitution than $Co(NH_3)_6^{3+}$, and that substitution which starts on a given cobalt atom goes to completion. The reaction is more facile at higher temperatures.

Pennsalt Chemicals Corp., Wyndmoor, Pa.
THE THERMAL STABILITY OF METAL AMMINES. II. COBALT (II) AND COBALT(III) COMPOUNDS, by L. R. Ocone, J. R. Soulen, and B. P. Block. Technical rept. no. 6 on Contract Nonr-2687(00). 1 Aug 59, 14p. 11 refs. AD-225 419.
Order from LC mi$2.40, ph$3.30 PB 148 136

The thermogravimetric behavior of seven cobalt ammines has been examined in a nitrogen atmosphere. Chelation increases thermal stability with six-membered rings showing greater stability than five-membered rings in chelates of tetrahedral cobalt (II). In all cases examined the ammines of cobalt (III) began to lose weight well under 200°C. No significant difference was detected in the thermal response of the cis and trans forms of $[Co(NH_3)_4Cl_2]Cl$. (Author)
(See also PB 148 133)

Pennsylvania U., Philadelphia.
RESEARCH ON A NEW CLASS OF INORGANIC MOLECULES CONSISTING BASICALLY OF SULFUR AND NITROGEN, by M. E. Cohen, R. A. Kent and others. Rept. on Contract AF 33(616)5444. Apr 60, 22p. 13 refs. WADD Technical rept. 60-169.
Order from OTS $0.75 PB 161 883

The silicon amines, $(C_6H_5)_3SiNH_2$, $(C_2H_5)_3SiNH_2$ and $[(CH_3)_3Si]_2NH$ have been found to react with either S_2Cl_2 or SCl_2. No pure silicon derivatives of tetrasulfur tetranitride, S_4N_4, of the type $(R_3Si)_4S_4N_4$, $(R_3Si)_3S_5N_2$, $(R_3SiNS)_x$ etc. analogous to those formed by carbon amines, could be isolated from the reaction products. NH_2CN, $CO(NH_2)_2$ and $CO(NHCH_3)_2$ were found to react with S_2Cl_2 to give complex polymeric materials. S_4N_4 was found to react violently with $C_6H_5PCl_2$ at room temperature to give high yields of the linear phenyl phosphonitrilic chloride oligomer, $(C_6H_5PNCl)_4 \cdot C_6H_5PCl_4$. S_4N_4 was found to react with anhydrous HBr and HF at room temperature, to produce, in the former case, a mixture of S_4N_3Br and NH_4Br. S_4N_3Cl has been found to react with a number of amines to give semi-solid viscous materials.

Richmond Research Lab., Stauffer Chemical Co., Calif.
INORGANIC POLYMERS PROGRAM, by A. J. Leffler and F. W. Breuer. Semi-annual technical rept. for 1 July 58-1 Jan 59 on Contract Nonr-2259(00). 18 Sep 59, 61p. 29 refs. AD-227 693.
Order from LC mi$3.90, ph$10.80 PB 148 594

The reactions of tris-trimethylsilylphosphine were further investigated, and their thermal decompositions yielded hexamethyldisilane plus an unknown liquid. Reaction with diphenyldichlorosilane yielded low-molecular-weight polymers. The reaction of halogenated nitriles and diborane yielded stable borazenes; the reaction with difunctional materials is under investigation. An attempt to prepare $[H(CF_2)_4CH_2]_3P$ by the reaction of $H(CF_2)_4CH_2I$ and $NaPH_2$ in liquid ammonia yielded $H(CF_2)_3CF = CH_2$. The reaction of perfluoroadipodinitrile with ammonia yielded a mixture of cyclic imidine and diamidine. Homopolymerization of cyclic perfluoroglutaroimidine was investigated. Special reaction conditions were studied which consistently produced a polymer different from the known highly cross linked species. The cross-linked homopolymer was attacked by amidines and ammonia giving rise to side reactions which may also occur with the copolymers. Mechanisms for both the homopolymerization of the cyclic glutaroimidine and its copolymerization with amidines was proposed. A modified polymerization method consisting of the reaction of perfluorobutyroamidine and perfluoroglutarodinitrile gave a more uniform polymer, but the properties were not satisfactory. This reaction will be studied by the preparation of low-molecular-weight analogs.

Sarah Mellon Scaife Radiation Lab., U. of Pittsburgh, Pa.
THE HYDRATES OF THE TETRA n-BUTYL AND TETRA i-AMYL QUATERNARY AMMONIUM SALTS, by Richard McMullan and G. A. Jeffrey. Technical note on Contract AF 49(638)456. June 59, 13p. 10 refs AFOSR-TN-59-475; AD-215 718.
Order from LC mi$2.40, ph$3.30 PB 146 527

The several prepared compounds are believed to be of the clathrate type, similar in general character to the gas hydrates. Actually, as shown, the compounds form several series.

Washington U., Seattle.
HALOGEN FLUOROSULFONATES $BrSO_3F$, $Br(SO_3F)$ AND $I(SO_3F)_3$; PREPARATION OF MERCURY(II), NITROSYL AND NITROSONIUM FLUOROSULFONATES FROM PEROXYDISULFURYL DIFLUORIDE [AND] SOME REACTIONS OF FLUORINE FLUOROSULFONATE: IODINE TRIFLUORIDE BISFLUOROSULFONATE, by George H. Cady and John E. Roberts (U. of Massachusetts). Technical rept. nos. 23-25 on Contract Nonr-477(16). 1959, 17p. 22 refs. AD-219 821.
Order from LC mi$2.40, ph$3.30 PB 148 138

Bromine (I) fluorosulfonate, bromine (III) fluorosulfonate and iodine (III) fluorosulfonate have been prepared by reacting peroxydisulfuryl difluoride with the appropriate halogen. These compounds have been characterized. Chlorine does not react with peroxydisulfuryl difluoride. Attempts to prepare lower fluorosulfonates of iodine have given inconsistent results. Peroxydisulfuryl difluoride reacts with nitric oxide to give nitrosyl fluorosulfonate and with mercury to give mercury (II) fluorosulfonate. With nitrogen dioxide an equimolar mixture of nitrosyl and nitronium fluorosulfonates is produced. The reaction products have been characterized. Fluorine fluorosulfonate reacts with sulfur dioxide to give pyrosulfuryl fluoride and with thionyl fluoride to give peroxydisulfuryl difluoride and thioryl tetrafluoride. With iodine, fluorine fluorosulfonate reacts to from iodine trifluoride bisfluorosulfonate, $IF_3(SO_3F)_2$. This new compound has been characterized. Chlorine does not react with fluorine fluorosulfonate. (Author)

Organic Chemistry

Callery Chemical Co., Pa.
THE PREPARATION, UNIT CELLS, AND SPACE GROUPS OF TWO ETHERATES OF SODIUM TRIDECAHYDRODECABORATE(1-) by H. G. Norment, Jr. Rept. on Project Zip, Contract NOa(s) 58-454-d. 25 May 59, 8p. 1 ref. CCC-454-TR-312; AD-220 682.
Order from LC mi$1.80, ph$1.80 PB 148 373

The mono-ethyl etherate of sodium tridecahydrodecaborate(1-), $NaB_{10}H_{13}$ $(C_2H_5)_2O$, and the bismethyl etherate of sodium tridecahydrodecaborate(1-), $NaB_{10}H_{13} \cdot 2$ $(CH_3)_2O$, have been prepared. Unit cell dimensions and space groups were determined for both materials by single-crystal x-ray diffraction techniques. (Author)

Olin Mathieson Chemical Corp., Niagara Falls, N. Y.
INVESTIGATION OF INTERMEDIATES OF CERTAIN SELECTED K AGENTS, by Max M. Boudakian. Final research rept. for 16 Aug 57-31 Mar 58 on Proj. Kreole, Contract DA 18-108-405-cml-29. 1 Aug 58, 118p. 95 refs. OMCC-9031-KFRR-1; AD-213 543.
Order from LC mi$6.00, ph$18.30 PB 148 483

The specific compound of major interest to the U. S. Army Chemical Corps in the synthesis of K-agents is 5-(1,2-dimethylheptyl) resorcinol. Since the classical synthesis route to this compound involves numerous steps with a low overall yield, a program was designed to develop a shorter and improved process for the synthesis of 5-(1,2-dimethylheptyl) resorcinol and certain key intermediates, such as 3,5-dihydroxyacetophenone and 3,5-dimethoxyacetophenone.

Pennsalt Chemicals Corp., Wyndmoor, Pa.
SULFUR-NITROGEN SYSTEMS. 1. POLYMERS FROM SULFAMIDE, by F. L. Scott and H. Q. Smith. Technical rept. no. 5 on Contract Nonr-2687(00). 1 Aug 59, 24p. 13 refs. AD-225 089.
Order from LC mi$2.70, ph$4.80 PB 148 135

Formaldehyde, sulfamide, and melamine were allowed to react under condensation conditions at a pH of 10 to yield white solids which were resistant to most solvents and had melting points ranging from 220° to 260°C. The IR spectra indicated a structure which resembled polymethylene polysulfamide. The polymers could be pressed into films on a Carver press at about 210°C and 11,000 lb. Polymerizations run at pH 7 yielded the same product as at pH 10, except in smaller yield. This suggested that the active moiety in the facile cross-linking prowess of sulfamide was the sulfamide ion. Further experiments revealed the condensation of sulfamide with formaldehyde, even in the presence of stoichiometric quantities of base was much more rapid than the rearrangement of sulfamide to imidodisulfamide. Variations in the quantities of the reactants which were used to produce the sulfamide-based polymers caused no pronounced effects on the thermal properties of the polymers.

Roosevelt U., Chicago [Ill.]
THE CHEMISTRY OF PROXIMATE AZIDO- AND THIO- GROUPS, by Eugene Lieber. Final technical rept. for 1 Sep 59-15 Feb 60 on Contract DA 11-022-ORD-3221. Feb 60, 86p. 56 refs. OOR rept. 2497.1-C; AD-235 469.
Order from LC mi$4.80, ph$13.80 PB 148 532

The present investigation concerns the synthesis of 5 (carbon-carbon substituted)-1, 2, 3, 4-thiatriazoles, and the physical properties of these systems. The infrared absorption spectra of the initial diazothization products of a series of 4-substituted thiobenzhydrazides clearly show that these compounds are not open chain azides, and confirms some recent investigations showing that these products are 5(para-substituted)-phenyl-1, 2, 3, 4-thiatriazoles. The reaction of sodium thiobenzoylthioglycolates with sodium azide in aqueous solution has been investigated and is found to give good yields of 5(para-substituted)phenyl-1, 2, 3, 4-thiatriazoles, identical with those formed by the diazotization

of 4-substituted thiobenzhydrazides. A study of the infrared absorption spectra of 4-substituted thiobenzhydrazides and aliphatic thiohydrazides shows that there exists no thione-thio tautomerism in their solid state. The 5(para-substituted)phenyl-1, 2, 3, 4-thiatriazoles exhibit aromatic type absorption in the ultraviolet region. The 1, 2, 3, 4-thiatriazole nucleus is electron-withdrawing in nature. All of the 5(para-substituted)phenyl-1, 2, 3, 4-thiatriazoles decompose at their melting points with the formation of 4-substituted phenyl nitriles, sulfur and nitrogen gas. The 5-aliphatic-1, 2, 3, 4-thiatriazoles are unstable and decompose upon formation, even at zero degrees centigrade. (Author)

Sterling Chemistry Lab., Yale U., New Haven, Conn.
THE EPOXIDATION OF SOME ALLYLIC ALCOHOLS, by James English and M. L. Sassiver. (Doctoral thesis). Rept. on Contract AF 49(638)37. [1960] 23p. 30 refs. AFOSR TN-60-247; AD-233 601.
Order from LC mi$2.70, ph$4.80 PB 147 228

The composition of the mixtures of stereoisomers produced on epoxidation of a series of allylic alcohols ($RCHOHCH=CH_2$) has been determined.

Yale U., New Haven, Conn.
INVESTIGATION OF INITIAL FREE RADICAL YIELDS IN ORGANIC COMPOUNDS SUBJECTED TO GAMMA RADIATION, by Randolph H. Bretton and Imre Zwiebel. Rept. for 1 July 57-30 June 59 on Contract AF 33(616)5239. Apr 60, 46p. 32 refs. WADD Technical rept. 60-127.
Order from OTS $1.25 PB 161 849

Satisfactory analytical and operational procedures for the use of DPPH (diphenylpicrylhydrazyl) as a scavenger in free radical yield determinations have been developed. These procedures are used to determine the free radical yields resulting from the irradiation of organic compounds in a Cobalt-60 gamma source. This report includes a summary and discussion of the radiochemical theory relating to the problem, followed by a literature survey on the specific project of the irradiation of alcohols. The theory underlying the use of scavengers is presented and the results of a detailed study of the specific scavenger DPPH, are given. Preliminary results for the irradiation of ethyl alcohol and acrylonitrile are presented. (Author)

Physical Chemistry

Arizona State U., Tempe.
THERMOELECTRIC MATERIALS AND DEVICE RESEARCH, by B. R. Gossick and H. B. Whitehurst. Quarterly progress rept. no. 1, 18 Sep-17 Dec 59, on Contract DA 36-039-sc-85249. [1960] 17p. 6 refs. AD-232 816.
Order from LC mi$2.40, ph$3.30 PB 148 342

Previous knowledge concerning the thermal and electrical properties of rutile which would make it useful as a thermoelectric material is briefly discussed. A modification of the material which might improve the thermoelectric figure of merit is proposed. Experimental efforts to produce rutile in a suitable form by the treatment of colloidal precipitates is described. (Author)

Avco-[Everett] Research Lab., Mass.
RATES OF SELECTED REACTIONS INVOLVING NITROGEN AND OXYGEN, by Norman Davidson. Rept. on Contract AF 04(645)18. June 58, 16p. 24 refs. Research rept. 32; AD-205 514.
Order from LC mi$2.40, ph$3.30 PB 147 397

This report summarizes the results of kinetic studies of reactions other than dissociation involving compounds of nitrogen and oxygen. Not all of the extensive literature in the field is reviewed here. Attention is focused on those papers which, so far as the author knows, provide the best data. Kinetic studies with the single pulse shock tube are described in detail, because this new method is of particular interest for high temperature gas dynamics.

Avco-Everett Research Lab., Mass.
VARIATIONAL THEORY OF CHEMICAL REACTION RATES APPLIED TO THREE-BODY RECOMBINATION, by James Keck. Rept. on Contract DA 19-020-ORD-4862. Sep 59, 67p. 19 refs. Research rept. 66; AD-227 520.
Order from LC mi$3.90, ph$10.80 PB 147 208

A variational theory which gives a least upper bound to the rate of a chemical reaction is presented. Explicit calculations of the recombination rate of attracting atoms in the presence of repulsive third bodies are made for a simple trial surface having one adjustable parameter. At low temperatures, the experimental rate constants are quite close to the theoretical bounds; at high temperatures, the experimental data fall away.

Baylor U., Waco, Tex.
THE MECHANISM OF THE ACTION OF ORGANIC BRIGHTENING AGENTS IN ELECTROPLATING PROCESSES, by Thomas C. Franklin and Jack R. Goodwyn. (Doctoral thesis). Technical rept. no. 1 for 10 Sep 56-10 Apr 60 on Contract DA 23-072-ORD-1056. [1960] 139p. 100 refs. OOR rept. 1747.2-M.
Order from LC mi$6.90, ph$21.30 PB 148 444

The causes of the maxima observed in the current-voltage curves for the oxidation of hydrogen at a black nickel electrode in basic solution and at a gray palladium electrode in basic and acidic solutions have been investigated and found to be due to the oxidation of two forms of hydrogen adsorbed on the surface of the electrode and hydrogen absorbed in the bulk of the electrode. The one maximum in the current-voltage curve for a nickel electrode plated in a Watts type bath is due to the oxidation of absorbed hydrogen. When certain organic compounds are added to a Watts bath, the concentration which produces the brightest deposit also produces the deposit containing the minimum amount of absorbed hydrogen. Curves relating the current efficiency of hydrogen ion discharge and the hydrogen

content of electrodeposits to the concentration of organic compound in the plating bath are similar in shape. The fact that the organic compounds affect the hydrogen polarization and nickel polarization differently explains the variation in the current efficiency and hydrogen content of the deposits when such compounds are added to the plating bath. (Author)

Bureau of Mines, Bartlesville, Okla.
COMBUSTION CALORIMETRY I. ORGANIC FLUORINE COMPOUNDS, by W. D. Good and D. W. Scott. Technical note on Contract BPSN 88-801A, ARPA Order no. 24-59, Task 3. 3 Aug 59, 37p. 17 refs. AFOSR-TN-59-698; AD-219 968
Order from LC mi$3.00, ph$6.30 PB 146 580

The contents of this Technical Note are to appear as a chapter in the book "Experimental Thermochemistry, Vol. II," being prepared under auspices of the Sub-Commission on Experimental Thermochemistry of the International Union of Pure and Applied Chemistry. The combustion calorimetry of organic fluorine compounds is discussed, and experimental procedures are recommended. A computation form is given for reducing the experimental results to standard states. Also discussed are factors influencing accuracy, choice of reference substances, and publication of results. (Author)

Bureau of Mines, Bartlesville, Okla.
COMBUSTION CALORIMETRY II, ORGANOMETALLIC COMPOUNDS, by W. D. Good and D. W. Scott. Technical note on Contract BPSN 88-801A. 3 Aug 59, 33p. 47 refs. ARPA Order no. 24-59, Task 3; AFOSR TN-59-699; AD-219 970.
Order from LC mi$3.00, ph$6.30 PB 146 601

The contents of this note are to appear as a chapter in the book "Experimental Thermochemistry, Vol. II," being prepared under auspices of the Sub-Commission on Experimental Thermochemistry of the International Union of Pure and Applied Chemistry. The combustion calorimetry of organometallic compounds and other carbon compounds of metals is discussed. References are given to past work in the field. Limitations of static-bomb methods and advantages of rotating-bomb methods are pointed out. Other topics treated are: Corrections to standard states; comparison experiments; materials for the bomb, fittings, and crucible; containers for samples; problem of complete combustion; and publication of results. (Author) (See also PB 146 580)

California U., Berkeley.
THE CHEMILUMINESCENCE OF ETHYLENE FORMED PROBABLY FROM METHYLENE IN AN INERT MATRIX, by Theodore D. Goldfarb and George C. Pimentel. Rept. on Contract AF 49(638)1. 10 Feb 60, 13p. 10 refs. AFOSR-TN-60-182; AD-233 368.
Order from LC mi$2.40, ph$3.30 PB 146 718

An orange-red luminescence occurs when diazomethane suspended in solid nitrogen or solid argon is photolyzed and then warmed to permit diffusion. Spectrographic and visual studies of this thermoluminescence are reported. Conditions favorable for the production of the luminescence also result in relatively high yields of ethylene as a final product. Furthermore, a deuteration effect is observed.

Callery Chemical Co., Pa.
PHYSICAL PROPERTIES OF BORON TRIBROMIDE, by W. F. Barber, C. F. Boynton, and P. E. Gallagher. Rept. on Project Zip, Contract NOa(s) 58-454-d. 25 Mar 59, 18p. 10 refs. CCC-454-TR-306; AD-220 681.
Order from LC mi$2.40, ph$3.30 PB 148 374

The triple point of a sample of 99.96 mole percent boron tribromide has been found to be -46.482°C. Over the temperature range -20 to 90°C, the density values have been found to fit the equation $d(g/ml) = 2.6954 - [2.962 \times 10^{-3} t_{(°C)}]$. Over the temperature range 0° to 90°C, the viscosity values have been found to fit the equation log η (millipoises) = 331/t - 0.250. Over the temperature range 22° to 84°C, the surface tension values have been found to fit the equation γ (dynes/cm) = 31.9 - 0.128 t (°C). Over the temperature range 0 to 90°C, the vapor pressure values have been found to fit the equation log $P_{(mm)} = 6.9795 - 1311/[t_{(°C)} + 230]$. (Author)

Carnegie Inst. of Tech., Pittsburgh, Pa.
CATALYTIC PYROLYSIS OF DIBORANE, by R. B. Beckman (Carnegie Inst. of Tech.). Rept. on Project Zip, Contract NOas-52-1024-c. 9 Dec 57, 21p. 4 refs. CCC-1024-TR-272.
Order from LC mi$2.70, ph$4.80 PB 149 191

The feasibility of catalyzing a directed pyrolysis of diborane to higher boron hydrides, by means of commercially available catalysts, was investigated. In general, the results indicate that the usual metal catalysts such as nickel, activated alumina, and platinum have some catalyzing properties. The data, unfortunately, are too meager to demonstrate whether or not this catalysis is directional for the desired liquid products. With the solid catalysts tested it was always found that solid degradation products eventually stopped the reaction.

Columbia U., New York.
ANOMALOUS RELAXATION OF HYPERFINE COMPONENTS IN ELECTRON SPIN RESONANCE, by Jan W. H. Schreurs, George E. Blomgren, and George K. Fraenkel. Technical note rept. no. 3 on Contract AF 49(638)520. 1 Jan 60, 27p. 20 refs. CU-3-60-AF-520-Chem.; AFOSR-TN-59-1326; AD-233 724.
Order from LC mi$2.70, ph$4.80 PB 146 749

Different hyperfine components in the electron resonance spectra of free radicals exhibiting proton hyperfine splitting were found to saturate at different rates, and it is pointed out that different sets of relaxation times must be used to describe the behavior of each component. An analysis is given of the experimental parameters which affect saturation measurements. An appendix is included on the work of Jen, et al. [Phys. Rev. 112:1169, 1958], on deuterium atoms trapped at liquid helium temperatures; this work shows that the anomalous intensities obtained as a function of r-f power is not the same as the phenomenon observed

for free radicals in solution, and cannot be adequately interpreted in terms of any currently proposed mechanisms. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
METHYLENE DERIVATIVES AS INTERMEDIATES IN POLAR REACTIONS. XIX. THE REACTION OF POTASSIUM ISOPROPOXIDE WITH CHLOROFORM, BROMOFORM AND DICHLOROFLUOROMETHANE, by Jack Hine, Arthur D. Ketley and Kozo Tanabe. Technical rept. no. 5 on Contract Nonr-991(03). 13 May 59, 22p. 21 refs.
Order from LC mi$2.70, ph$4.80 PB 148 795

On reaction with potassium isopropoxide in isopropl alcohol, dichlorofluoromethane gives triisopropyl orthoformate as the only product detected, while chloroform and bromoform give, in addition, propylene diisopropyl ether, acetone, carbon monoxide, a methylene halide, and under some conditions dark-colored products of higher molecular weight. Mechanistic interpretations are given for some of these and related observations. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
METHYLENE RADICALS IN SOLUTION, by Jack Hine, Arthur D. Ketley and others. Final rept. on Contract Nonr-991(03). 16 June 59, 4p. AD-218 179.
Order from LC mi$1.80, ph$1.80 PB 147 263

Studies were made of the reactions of alcohols and alkoxy and aryloxy anions with dihalomethylenes generated from haloforms and bases. The Riemer-Tiemann reaction proceeded via a dihalomethylene intermediate, but dibromomethylene, dichloromethylene, and chlorofluoromethylene reacted with potassium isopropoxide in isopropyl alcohol in a different manner. Isopropyl difluoromethyl ether, prepared by the action of potassium isopropoxide in isopropyl alcohol on chlorodifluoromethane, was inert to potassium isopropoxide at 0° and 50°C. A new method for drying and determining the water content of isopropyl alcohol was developed, and from this data the true second-order rate constants for the hydrolysis of an ester by hydroxide ion in alcoholic solution were calculated. Potassium isopropoxide reacted with dichlorofluoromethane to give high yields of triisopropyl orthoformate and with chloroform and bromoform to give methylene halides, carbon monoxide, propylene, diisopropyl ether, and acetone.

Grace, W. R., and Co., Clarksville, Md.
INVESTIGATION OF THIN SHEETS OF HIGH-QUALITY, SINGLE-CRYSTAL SILICON, by F. T. Fitch. Technical summary rept. no. 1, 1 Sep 59-29 Feb 60, on Contract DA 36-039-sc-85242. 10 Mar 60, 30p. AD-234 238.
Order from LC mi$2.70, ph$4.80 PB 148 551

Due to its high surface tension, molten silicon forms a liquid lens of about 4 mm equilibrium depth on a lead surface. The saturation concentration of lead slightly above the silicon melting point is about 17% Pb. Lead is definitely volative at these temperatures and difficulties are encountered in controlling the lead vapors and losses from the system. Lead does not form a solid solution with silicon. When detected at definite levels in the samples, the lead was present as a finely dispersed metal phase. Silicon single crystals have been pulled with lead additions up to 5% in the melt. Their lead content was very low (<0.01%). Polycrystalline material was obtained at a lead concentration >10% in the melt. This appeared to reflect a need for improved pulling techniques as much as the possibility of a limiting lead concentration at which a single crystal may be obtained. A high-temperature furnace suitable for the study of the Si-Pb system has been assembled and checked through initial operation

Harvard U., Cambridge, Mass.
NUCLEAR MAGNETIC RESONANCE AND INFRARED ABSORPTION SPECTRA STUDIES OF ORGANOSILANES AND RELATED COMPOUNDS, by David David E. Webster. Technical rept. on Contract Nonr-1866(13). Aug 59, 42p. 34 refs. AD-228 133.
Order from LC mi$3.30, ph$7.80 PB 148 174

Contents:
The nuclear magnetic resonance spectra of some trisubstituted silanes; the electronegativity of substituents, by David E. Webster
Nuclear magnetic resonance studies of some methyl derivatives of the group IVB elements, by M. P. Brown and D. E. Webster
The nuclear magnetic resonance spectra of some methylhydropolysiloxanes, by D. E. Webster and R. Okawara
The infrared spectra of the methylacetoxysilanes and some methyltin carboxylates, and the configuration of the trimethyltin and the dimethyltin cations, by Rokuro Okawara, D. E. Webster, and Eugene G. Rochow

Instituto di Chimica Generale dell? Universita, Palermo (Italy).
THERMODYNAMICS OF THE EQUILIBRIA BETWEEN Ni(DBH) AND A SERIES OF NITROGEN BASES IN BENZENE, by Luigi Sacconi. Final technical rept. no. 2, 1 Apr 59-31 Mar 60, on Contract DA 91-591-EUC-1105. [1960] 19p. 11 refs.
Order from LC mi$2.40, ph$3.30 PB 148 360

The equilibria in benzene between NiDBH and 20 nitrogen bases has been studied. From the spectrophotometric data the values of log K at different temperatures have been obtained. From the temperature dependence of the formation constants, the heats of reaction and free energy and entropy changes were calculated. The data are discussed in terms of structural and electronic factors. In the equilibria with cyclic polymethylenimines the existance of a competition between front- and internal strain is revealed. The double bond of unsaturated amines (mono- and diallylamine) causes lowering of the donor affinity of these bases. The introduction of a phenyl group in the alpha position into alkylamines results in -I effect and steric hindrance. The donor affinity of NH_2-, CN- and $COOCH_3$-substituted pyridines roughly parallels the polarity ($-\Sigma\sigma^*$) of these bases.

Little, Arthur D., Inc., Cambridge, Mass.
IONIC-MODEL CALCULATIONS: I. THE LITHIUM HALIDES, by Alfred Büchler. Interim technical rept. no. 2 on Study of High-Temperature Thermodynamics of Light-Metal Compounds, Contract DA 19-020-ORD-4829. 20 Apr 60, 11p. 17 refs. OOR rept. 006. 2-C.
Order from LC mi$2. 40, ph$3. 30 PB 148 430

The effect of the introduction of the higher multipole polarizabilities of ions on ionic-model calculations has been investigated. In the case of the lithium halides, the agreement between the observed and calculated vibration-rotation constants that is obtained when only dipole polarizabilities are used is destroyed when higher polarizabilities are introduced. The agreement between the observed and calculated dissociation energies is not affected. (Author)

Little, Arthur D., Inc., Cambridge, Mass.
IONIC-MODEL CALCULATIONS: II. THE BENDING FORCE CONSTANTS OF THE GROUP II HALIDES, by Alfred Büchler. Interim technical rept. no. 3 on Study of High-Temperature Thermodynamics of Light-Metal Compounds, Contract DA 19-020-ORD-4829. 15 Apr 60, 19p. 14 refs. OOR rept. 006. 3-C.
Order from LC mi$2. 40, ph$3. 30 PB 148 431

The bending force constants of the Group II halides have been calculated for three versions of an ionic model of these molecules. The first version treats the ions as point charges; the second includes their dipole polarizabilities; the third is based on a multipole expansion that includes all terms up to the charge-(induced octupole) term. The calculations show that the ionic model cannot account for the observed magnitude of the bending force constants. (Author) (See also PB 148 430)

Louisiana State U., Baton Rouge.
FARADAIC RECTIFICATION WITH CONTROL OF ALTERNATING POTENTIAL VARIATIONS. APPLICATION OF ELECTRODE KINETICS FOR FAST PROCESSES, by Hiroaki Matsuda and Paul Delahay. Technical rept. no. 38 on Contract Nonr-300(00). Sep 59, 17p. 9 refs. AD-233 311.
Order from LC mi$2. 40, ph$3. 30 PB 148 575

The potential of an electrode at which a fast charge transfer process occurs is varied about the equilibrium potential according to a sinusoidal function of time. The resulting alternating current includes a rectification component because of the asymmetry of the current-potential curve. An equation is derived for the faradaic rectification current and is compared with a previous result obtained on the assumption of current control for $t \rightarrow \infty$. A correction for the double layer structure in the solution of the boundary value problem is also derived. (Author)

Louvain U. (Belgium).
KINETICAL PARAMETERS IN PREMIXED LAMINAR FLAMES, by A. Van Tiggelen, R. Corbeels, and H. Vandenabeele. Technical note no. 2 on Contract AF 61(514)1245. Feb 60, 41p. 17 refs. AFOSR-TN-59-1149; AD-234 580.
Order from LC mi$3. 30, ph$7. 80 PB 146 640

Activation energy and reaction order in CH_4-O flames: Experimental burning velocities, obtained at different fuel-to-O ratios, dilutions with N, and initial temperatures of the fresh gases, are almost perfectly represented by a formula where the classical kinetic parameters of a chemical reaction are present (activation energy (38 kcal) and reaction order with respect to O (1. 4), and to CH_4(-0. 4)). The empirical formula corresponds exactly to the theory with a chain-mechanism including the formation of a peroxide radical (CH_3O_2). Reaction order in acetylene -O flames: The activation energy obtained was 31 kcal. The reaction order with respect to O varies between 2 and 0. 8 and between -1 and 0. 2 with respect to acetylene; the sum of both orders was always equal to unity and the negative value with respect to acetylene was valid at the rich side. A chain reaction with the formation of a peroxide must also occur in acetylene-O flames. Flame propagation velocity: CH_4-H-O mixtures: Burning velocities and flame temperatures in stoichiometric ternary CH_4-H-O mixtures at different dilutions with N were measured. These mixtures seem to correspond to a case of weak interaction between the 2 separate reactions. The activation energy is about equal to the value given by a linear interpolation between the 2 extreme values (18 kcal for pure H and 38 for pure CH_4).

Massachusetts Inst. of Tech., Cambridge.
TWO-DIMENSIONAL GASEOUS DETONATIONS I. THE VELOCITY DEFICIT, by James A. Fay. Rept. on Contract Nonr-1858(25). Mar 59, 24p. 15 refs. Proj. Squid Technical rept. MIT-21-P.
Order from LC mi$2. 70, ph$4. 80 PB 146 596

The measured velocity of gaseous detonation waves is less than that predicted by the Chapman-Jouguet plane wave theory. The velocity deficit (difference between theoretical and measured velocities) has been found to vary inversely with the tube diameter and initial pressure. A quantitative explanation of this effect is advanced by determining the growth of the viscous boundary layer on the tube wall and its effect upon the flow in the reaction zone of the detonation front.

Massachusetts U., Amherst.
SOME LIGHT SCATTERING STUDIES OF THE TEXTURE OF CRYSTALLINE POLYMERS, by Richard S. Stein. Technical rept. no. 12 on Contract Nonr-2151(00). 24 July 59, 39p. 25 refs. AD-225 701.
Order from LC mi$3. 30, ph$6. 30 PB 147 264

Contents:
Angular variation of scattering
Changes on heating and cooling
Density and orientation fluctuations
The resolution of orientation and density contributions
The effect of swelling
The variation of polarization during crystallization
The effect of ringed spherulites
The effect of stretching
The polarization of light scattered from stretched samples

Minnesota U., Minneapolis.
NUCLEAR AND ELECTRON SPIN RESONANCE, by John E. Wertz. Final rept. on Contract AF 18(600)479. 29 Feb 60, 86p. 63 refs. AFOSR-TR-60-69.
Order from LC mi$4.80, ph$13.80 PB 147 917

It is shown that for magnesium oxide electron spin resonance spectra may be used to detect and to give detailed descriptions of many of the known types of defect centers. It has been possible to make numerous correlations with other physical properties.

Noyes Chemical Lab., U. of Illinois, Urbana.
A CRITERION FOR ORBITAL HYBRIDIZATION AND CHARGE DISTRIBUTION IN CHEMICAL BONDS, by Martin Karplus and D. M. Grant. Technical rept. no. 21 on Contract Nonr-1834(13). 29 June 59, 11p., 21 refs. AD-220 346.
Order from LC mi$2.40, ph$3.30 PB 147 259

A theory is advanced which suggests that electron-coupled nuclear spin interactions, when interpreted in terms of the theory of localized electron pairs, can serve to measure the extent of orbital hybridization and bond polarization. Applications of the theory were made to systems of high symmetry in which hybridization and/or bond polarities are known, including BH_4^-, CH_4, and NH_4^+. Some non-tetrahedral systems were also studied whose nuclear magnetic resonance spectra were analyzed and whose X-H coupling constants were determined. The results obtained with the localized electron pair theory indicated that the coupling constant, $A_{NN'}$, was a useful criterion for the study of bond properties, since it is sensitive to the amount of hybridization and covalency in the wave function.

Ohio State U. Research Foundation, Columbus.
THERMAL FUNCTIONS AND HEATS OF FORMATION OF SOME OF THE MAJOR VAPOR SPECIES IN THE BORON-OXYGEN-HYDROGEN SYSTEM AT ELEVATED TEMPERATURES, by David White, Patrick N. Walsh and others. Technical rept. 4 on Contract Nonr-495(12). July 59, 25p. 10 refs; AD-225 417.
Order from LC mi$2.70, ph$4.80 PB 147 086

The thermodynamic properties of the gaseous molecules B_2O_3, B_2O_2, HBO_2 and $(HBO_2)_3$ are discussed in the light of the results of a spectroscopic investigation of the B-O-H- system. Extensive tables of thermal functions for these molecules are given. The heats of formation of these species, as well as others in the B-O-H system, are summarized, and the uncertainties discussed. These thermodynamic properties have been used to compute phase equilibria and partial pressures of the vapor species in the oxidation of boranes at various temperatures and stoichiometric ratios. (Author)

Pennsalt Chemicals Corp., Wyndmoor, Pa.
POLYMERS CONTAINING COORDINATED BORON, by C. R. Bertsch and H. C. Miller. Technical rept. no. 9 on Contract Nonr-2687(00). 10 Sep 59, 16p. 24 refs. AD-227 931.
Order from LC mi$2.40, ph$3.30 PB 148 569

Attempts were made to form linear polymers with tetracoordinated boron as the backbone element and using oxygen or CN groups to link the boron atoms. Inorganic bidentate ligands were used to block the two other coordination positions of the boron atom. No stable polymers were formed when sulfamate, aminomethanesulfonate, methanedisulfonate, or carbonate were used as the ligands. (Author)

Pennsylvania State U. Coll. of Mineral Industries, University Park.
ON THE BURNING RATE OF AN H-ATOM PROPELLANT, by Howard B. Palmer. Rept. on Contract Nonr-1858(25). Mar 59, 8p. 8 refs. Proj. Squid Technical rept. PSU-4-P.
Order from LC mi$1.80, ph$1.80 PB 146 595

The recent success of Windsor (Chem. and Eng. News, Jan. 12 (1959)) in trapping pure H atoms as a solid prompts added interest in the possibility of using H atom recombination for propulsion. For this reason, an attempt to calculate a priori the one-dimensional burning rate of an H-atom propellant seems worthwhile.

Princeton U., N. J.
ABSOLUTE INFRARED INTENSITIES OF THE AMMONIUM ION IN CRYSTALS, by C. C. Ferriso (Doctoral thesis) and D. F. Hornig. Technical rept. no. 2 on Contract Nonr-1858(27). 15 June 59, 18p. 20 refs. AD-220 137.
Order from LC mi$2.40, ph$3.30 PB 146 408

The absolute intensities of the 2 IR active fundamentals of the ammonium ion ν_3 and ν_4, were studied in several environments. Dilute solid solutions of NH_4^+ ions in KCl, KI, CsCl and CsI were studied and compared with pure NH_4I. After separating the effect of the net charge, the apparent bond moments ranged from 0.63d to 0.80d (ave. 0.71) and the bond dipole derivatives, $\partial \mu / \partial r$, from 2.06d/A to 3.59d/A (ave. 2.80d/A). The bond moment is substantially the same as in NH_3. (Author)

Quantum, Inc., Wallingford, Conn.
FUNDAMENTAL STUDIES OF THE CHEMISTRY AND PHYSICS OF ORGANIC MATERIALS ADSORBED ON METAL SUBSTRATES, by Hilton A. Roth, Ralph F. Lumb, and C. M. Doede. Rept. on Surface and Interface Phenomena of Matter, Contract AF 33(616)3882. Apr 60, 149p. 22 refs. WADD Technical rept. 59-23.
Order from OTS $2.75 PB 161 840

This research was an experimental exploration into the nature of the overall chemical and/or physical forces active at the interface between a continuous solid surface and an adsorbed thin film. In Part I disubstituted siloxane oriented polymeric films were synthesized lineally and normally on the surface of steel. Tensile strengths of these films were measured. Efforts were made to synthesize semi-inorganic and organic phosphorus containing polymers on this surface. The efforts demonstrated that the reactivity of phosphorus containing monomers with the

surface is uncontrollable. The work involved an experimental study of the film forming properties of the surfaces of saturated aqueous selections of omega hydroxyundecanoic acid.. It also included an exploratory attempt to synthesize a thin film of oriented polyamide. In Part II a photochemical method was adapted to evaluate the energy required to break interfacial adsorption bonds. Radiotracer techniques were used. The adsorption systems consisted of stearic acid and octadecanol on steel. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
OXYGEN OVERPOTENTIAL IN MOLTEN CARBONATES, by George J. Janz and Francisco Colom. Technical rept. no. 4 on Contract Nonr-591(10). Sep 59, 25p. 8 refs. AD-226 419.
Order from LC mi$2.70, ph$4.80 PB 148 566

The overvoltage of the oxygen evolution reaction on Pt electrodes in a ternary mixture of molten Na_2CO_3-Li_2CO_3-K_2CO_3 has been studied from 420°C to 1000°C. The overvoltage–log current density relations exhibit two well distinguished regions over the entire temperature range. At high c. d. (greater than 10^{-3} amp/cm^2) the slope of the Tafel line is maintained in accord with the overall process; $CO_3^{=} \rightarrow CO_2 + O + 2\bar{e}$ with the value of 10. 4±1. 1 kcal mol^{-1} for the heat of activation for oxygen evolution. At low c. d. the overpotential appears to be a more complex problem with marked temperature dependence. A portion of the relation in this region of c. d. in the high temperature range (above 600°C) may be understood with reference to the properties of the Pt electrode as a reversible CO_2-oxygen electrode in such melts. (Author)

Rochester U., N. Y.
ENERGY TRANSFERAL IN POLYATOMIC MOLECULES AND PHOTOCHEMISTRY IN THE LIQUID AND SOLID PHASES, by W. Albert Noyes, Jr. Final rept. on Contract AF 18(600)1528. 1 Mar 60, 13p. 30 refs. AFOSR-TR-60-38.
Order from LC mi$2.40, ph$3.30 PB 148 090

A study of several years has shown that light and radiation produce free radicals in some instances and rearrangements to complete molecules in others. The reactions proceed mainly through two states, one of which is short lived and one of which lasts much longer. The rearrangements to complete molecules seem to come mainly from the short lived state and reactions which arise from reactive intermediates such as radicals start mainly from long lived states. Finally the powerful radiations from radioactive substances produce effects which in many cases resemble those formed by visible or ultraviolet light. (Author)

Rutgers State U., New Brunswick, N. J.
A STUDY OF THE PROPERTIES OF MATTER BY MEANS OF NUCLEAR MAGNETIC RESONANCE TECHNIQUES. Technical rept. for 1 Dec 55-31 Dec 31 Dec 59 on Contract AF 18(603)6. 26 Jan 60, 22p. 7 refs. AFOSR [TR]-60-17; AD-232 674.
Order from LC mi$2.70, ph$4.80 PB 146 334

Absorbtion of energy from radiofrequency fields was measured by nuclear magnetic moments at resonance; the effects were studied on such absorption signals of the internal motions of atoms in simple systems, especially in such systems as metal hydrides, liquid water, and gaseous and liquid Xeon. In other experiments enhancements of normal nuclear spin polarizations were induced by exciting resonances electron spins coupled to the nuclear spins by dipolar interactions in several liquids and solids. The shapes and intensities were studied of continuous steady-state nuclear resonance signals as affected by application of pulsed radio-frequency power. Under some circumstances considerable improvement in sensitivity results from proper combinations of such sources. Under other circumstances it may be possible to obtain very narrow band filtering. (Author)

South Carolina U., Columbia.
INTRAMOLECULAR FREE RADICAL ARYLATION AND RELATED REACTIONS, by DeLos F. DeTar and Chin-Chiun Chu (Doctoral thesis). Rept. on Contract AF 49(638)88. [1960] 24p. 27 refs. AFOSR-TN-60-157; AD-231 250.
Order from LC mi$2.70, ph$4.80 PB 147 346

A study has been made of the reactions of the 2-o-terphenyl free radical. Cyclization to triphenylene (IX) occurs to the exclusion of the intermolecular reaction with benzene or with carbon tetrachloride. However, bromine abstraction from bromotrichloromethane does compete with cyclization. The peroxide of o-(1-naphthyl)-benzoic acid (VI) was also investigated, but the acyloxy radical failed to decarboxylate. The main product found was the lactone (VIII) of o-(2-hydroxy-1-naphthyl)-benzoic acid. (Author)

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
THE MEASUREMENT OF THE VAPOR PRESSURE OF ATOMIC SPECIES FROM SPECTROPHOTOMETRIC MEASUREMENTS OF THE ABSORPTION OF RESONANCE LINES. I. TEST OF THE METHOD ON THE VAPOR PRESSURE OF SODIUM, by Guido L. Vidale. Rept. on Contract AF 04(647)269. May 60, 49p. 20 refs. Technical Information Series R60SD330.
Order from LC mi$3.30, ph$7.80 PB 148 206

A method has been developed for studying the equilibrium vapor pressure of atomic species over refractory ceramics. It consists of measuring the absorption coefficient of the hot equilibrium vapor at the center of an atomic resonance line. A resonance line of known oscillator strength for the atomic species under examination is generated in a liquid nitrogen cooled, hollow cathode discharge tube, and the absorption of this line by a known length of equilibrium vapor present in an isothermal cell is measured using spectrophotometric techniques. After correcting for the various causes of line broadening of the resonance line, the measured absorption is used to calculate the density of the atomic species. The experimental and theoretical techniques are described, and the results of a reinvestigation of the vapor pressure of sodium metal at 400°K are given. It is shown that the individual vapor pressure measurements have a root mean square deviation of 12%, and that their average differs from

the best literature values by less than 3%. The various sources of error are discussed quantitatively, and it is shown that pressure of 10^{-8} to 10^{-9} atmospheres of atomic species can be generally measured with an accuracy of ± 20%. (Author)

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
THE MEASUREMENT OF THE VAPOR PRESSURE OF ATOMIC SPECIES FROM SPECTROPHOTOMETRIC MEASUREMENTS OF THE ABSORPTION OF RESONANCE LINES. II. THE OSCILLATOR STRENGTH OF THE Cu_{3247} LINE, by G. L. Vidale. Rept. on Contract AF 04(647)269. May 60, 32p. 10 refs. Technical Information Series R60SD331.
Order from LC mi$3.00, ph$6.30 PB 148 207

The oscillator strength of the Cu_{3247} resonance line has been obtained from the experimentally determined absorption coefficient at its center. This resonance line was generated in a hollow cathode discharge tube operated at liquid nitrogen temperature and its absorption by an amount of copper vapor of known length and density was measured spectrophotometrically. The value of f was calculated from this measured absorption by taking into account the effect of Doppler and pressure broadening and of the hyperfine structure of the line. The copper vapor consisted of the equilibrium vapor over copper in an isothermal cell, in the presence of a sufficient density of inert gas to diffusion limit the effective cell length. The reported result f = 0.32 is compared with literature values, and its probable error is estimated. (Author) (See also PB 148 206)

Stanford Research Inst., Menlo Park, Calif.
THE DIFFUSION OF ATOMIC HYDROGEN THROUGH MULTICOMPONENT MIXTURES, by Henry Wise. Rept. on Project Squid, Contract Nonr-1858(25). Sep 59, 7p. 7 refs. Technical rept. SRI-4-P; AD-225 795.
Order from LC mi$1.80, ph$1.80 PB 148 588

The diffusion coefficient of atomic H through a mixture of Ar and H was determined at 30 x 10^{-3} mm Hg. The atomic H concentration along the center of the reaction tube was measured with a microcalorimeter consisting of a pyrex probe coated with a thin layer of vacuum-evaporated Pt. With increasing mole fraction of Ar, a marked reduction occurred in the ratio D_{123}/D_{12}. D_{13} had an average value of (2.88 ± 0.11) x 10^4 sq cm/sec at 30 x 10^{-3} mm Hg, which corresponds to an effective momentum-loss collision diameter $\sigma_{H,Ar} = 2.92 \times 10^{-8}$ cm as compared to $\sigma_{H,H_2} = 2.55 \times 10^{-8}$ based on a model of rigid elastic spheres.

Technische Hochschule, Munich (West Germany).
RESEARCHES ON HYDROGEN EVOLUTION, by C. A. Knorr. Rept. on The Structure and Properties on Interfaces, Contract AF 61(052)142. Apr 60, 50p. 60 refs. WADC Technical rept. 59-687.
Order from OTS $1.25 PB 161 880

Pt. I. Investigation of adsorption phenomena on platinum, rhodium, iridium, palladium and gold, by means of the potentiostatic method of applying a triangular voltage. Formation and decomposition of hydrogen and oxygen coverages as a function of the retardation of charge transfers. Pt. II. Investigation of the reaction of hydrogen occluded in Pd-wires with H-acceptors like chromic acid, potassium ferricyanide, and hydrogen peroxide, by the measurement of the longitudinal resistance. Study of the oxide surface with regard to the H^+ permeability and the influence of poisoning on the decomposition reaction. (Author)

Uppsala U. (Sweden).
HETEROPOLAR AND HOMOPOLAR BOND ENERGY, by Ingvar Lindqvist. Technical note no. 8 on Contract AF 61(052)43. 1 Mar 60, 10p. 3 refs. AFOSR-TN-60-127; AD-234 583.
Order from LC mi$1.80, ph$1.80 PB 146 742

A concept, heteropolarity, has been defined which permits the division of the bond energy of a localized electron pair bond into a heteropolar and a homopolar part. The variations of these two energy parts with respect to shifts of the heteropolarities of the bonds in binary molecules are discussed. It is suggested that the description of the bond energy proposed is well suited for discussions of inductive effects. (Author)

Uppsala U. (Sweden).
INDUCTIVE EFFECTS ON CHEMICAL BONDS, by Ingvar Lindqvist. Technical note no. 9 on Contract AF 61(052)43. 1 Mar 60, 37p. 24 refs. AFOSR-TN-60-126; AD-234 582.
Order from LC mi$3.00, ph$6.30 PB 146 743

Inductive effects on a given chemical bond, caused by substitution or addition reactions, have been discussed using an approach which divides the bond energy into a heteropolar and a homopolar part. It has been possible to give a unified treatment of experimentally established effects of the order of 0.01 Å. The nature of the donor-acceptor interaction has been discussed with consideration of the inductive effects on all the bonds in the donor and acceptor molecules. The consequences in halogen bridged compounds and in complex ions have also been treated briefly. (Author)

Uppsala U. (Sweden).
OXIDE CHLORIDES AND ORGANOMETALLOID OXIDES AS DONOR MOLECULES, by Ingvar Lindqvist. Technical note no. 10 on Contract AF 61(052)43. 1 Mar 60, 12p. 9 refs. AFOSR-TN-60-125; AD-234 581.
Order from LC mi$2.40, ph$3.30 PB 146 744

A model of an idealized structure has been suggested, which can be used for the discussion of adducts of oxide chlorides and organometalloid oxides. No safe distinction between single and double bond structures can be made with the experimental data available at present. The results show, however, the importance of inductive effects in donor-acceptor reactions, and some predictions can be made about other adducts than those studied. (Author) (See also AD-234 582)

Warner and Swasey Co., New York.
INFRARED SPECTRAL EMISSIVITIES AND INTERNAL DISTRIBUTIONS OF CARBON DIOXIDE AND WATER VAPOR AT HIGH TEMPERATURES, by Richard H. Tourin and Paul M. Henry. Final rept. on Contract AF 19(604)2223. Dec 59, 109p. 42 refs. AFCRC-TR-60-203; AD-233 493.
Order from LC mi$5.70, ph$16.80 PB 146 636

Infrared spectral emissivities of hot carbon dioxide and water vapor were determined by measurement of the infrared absorption spectra of gas samples heated under controlled conditions. The measurements are described and are discussed in relation to molecular energy distributions, theoretically calculated emissivities, and flame radiation. (Author)

Washington State U., Pullman.
THE INTERACTION OF ACTIVATED ATMOSPHERIC GASES WITH SOLID SURFACES, by Daniel G. Bills. Rept. no. 15 (Final) on Contract AF 19(604)1897. 31 Dec 59, 35p. 22 refs. AFCRC-TR-60-255.
Order from LC mi$3.00, ph$6.30 PB 148 742

This paper reports experimental investigations of several new effects connected with the adsorption on solids of nitrogen and hydrogen molecules which are not in their normal energy state. The new work reported here primarily concerns: (1) studies of the thermal decomposition of glass and its relation to 2 below; (2) studies of the chemical sputtering produced by activated molecules impinging on glass surfaces; (3) studies of means of reducing ionization gauge pumping; and (4) identification of the activated species in molecular nitrogen as non-ionic.

Washington State U., Pullman.
INTRODUCTION TO TABLES ON PYROLYSIS OF ESTERS. PYROLYSIS OF CARBOXYLATES, by Grant Gill Smith and Frank D. Bagley. Rept. on Contract AF 49(638)615. June 60, 87p. 320 refs. AFOSR-TN-60-590; AD-238 726.
Order from OTS $2.25 PB 161 866

This is the first table of a series summarizing the temperatures, yields and references for the pyrolysis of esters of organic and inorganic acids and closely related nitrogen and sulfur analogues. Only esters which contain a β-hydrogen on the alkyl group and could possibly pyrolyze to olefins are included. Some of the esters, e.g. unsaturated esters, do not pyrolyze to give olefins even though they have a β-hydrogen and might be expected to produce olefin, but produce other substances such as rearranged products; esters of this type are also included. No distinction is made between studies primarily interested in the products of pyrolysis and those studies for theoretical interest.

Wayne State U., Detroit, Mich.
THE DETERMINATION OF SIZE DISTRIBUTION CURVES BY LIGHT SCATTERING AND RELATED INVESTIGATIONS, by Morton L. Wallach. Doctoral thesis. Technical rept. no. 34 on Contract [Nonr]-736(00). 1 Aug 59, 82p. 70 refs. AD-226 072.
Order from LC mi$4.80, ph$13.80 PB 148 184

An investigation was undertaken in an effort to develop a method of determining particle size distribution curves in emulsions. Most of the conventional, well established methods of determining size distribution curves are not particularly suited to the analysis of emulsions. In contradistinction, light scattering should, in principle, be well adapted to the study of size distributions in emulsions. In general, a measurable contribution is made to the total observed effect even for very small colloidal particles. Five per cent differences in size can be detected for particles as small as 100 mμ in diameter. Experimental techniques established for monodispersed systems should serve equally as well in the case of heterodispersions. (Author)

Westinghouse Research Labs., Pittsburgh, Pa.
ELECTRICAL CLEANUP OF GASES, by R. E. Fox and J. S. Knoll. Final rept. 15 Mar 59-14 May 60, on Contract AF 49(638)591. 14 May 60, 23p. 10 refs. Research rept. 403FD428-R5; AFOSR-TR-60-72.
Order from LC mi$2.70, ph$4.80 PB 148 404

The short term re-emission studies have been extended down to times approaching 1 sec. These studies indicate that even at these short times, re-emission follows a 1/T dependence. Further studies are needed with a modified tube to carry the times to shorter intervals. Temperature dependence of the re-emission rate, as well as the pumpdown rate, has been carried out over a temperature range from room temperature down to liquid nitrogen (-200°C) temperature. This effect is significant and should be accurately controlled for re-emission studies. The studies of the dependence of ion energies on the re-emission rate were inconclusive due to the nature of the tube construction. The results indicate that the effect of ion pumping at the filament and/or its supports is more important for a tube of this geometry than had previously been suspected. (Author) (See also PB 136 138)

EARTH SCIENCES

American Geographical Society, New York.
RESEARCH ON LATE-PLEISTOCENE ENVIRONMENTS OF SOUTHERN CHILE, by Calvin J. Heusser. Semi-annual status rept. on Contract Nonr-641(04). 11 May 59, 11p. AD-218 165.
Order from LC mi$2.40, ph$3.30 PB 147 448

A reconnaissance study was made to determine southern Chilean late-Pleistocene environmental changes, particularly climatic fluctuations, and to construct chronology of these changes for comparison with chronologies from the northern hemisphere. Five methods were applied to gather data: (1) the palynology (pollen analysis) of the deposits formed in the lakes and bogs on and beyond the prominent Laguna de San Rafael moraine; (2) limnology of the water bodies associated with the above deposits and the geochemistry of those sediments; (3) glacial geology, since glacier variations, as indicated by moraine sequences, are governed primarily by climate; (4) glacier variations of the last several

centuries are measured and dated from the ages and growth patterns of woody plants established on recessional moraines and outwash, as well as along the trimlines of the glaciers; and (5) by means of radiocarbon dating, additional dates ranging from hundreds to thousands of years of the Late Pleistocene are obtained from organic remains associated with past events. The foundation for most of the chronology is based on ages determined by radiocarbon analysis. (Author)

Naval Ordnance Test Station, China Lake, Calif.
ATMOSPHERIC REFRACTION IN THE VISIBLE SPECTRUM, by R. J. Stirton. 1 Dec 59, 23p. 12 refs. NOTS TP-2357; NAVORD rept. 6614; AD-234 066.
Order from LC mi$2.70, ph$4.80 PB 146 995

The refraction of the atmosphere causes the apparent position of an object to be higher than its true position. The correction for this angular position is obtained in the form of an explicit integral. A computing program for the IBM 704 was written to handle the numerical work. A wide range of observer and object positions and some generality in the atmospheric properties are indicated. In particular, consideration is given to including local temperature and pressure observations in the functions representing the atmosphere. (Author)

Texas A. and M. Coll., College Station.
OCEANOGRAPHY AND METEOROLOGY OF THE GULF OF MEXICO, by Hugh J. McLellan. Annual rept. for 1 May 58-30 Apr 59 on Contract N7onr-48702. 1 May 59, 36p. 12 refs. Reference 59-16A, AD-220 441.
Order from LC mi$3.00, ph$6.30 PB 146 534

The project is now being oriented towards the problem of predicting oceanographic conditions. There are several aspects to these studies including sea state prediction and water mass characteristics. The placing of a telemetering weather buoy in the central Gulf during the summer of 1958, is the major item in these studies. A thermistor array is now being constructed for use in the buoy to report temperatures from 18 depths down to 300 m. Negotiations were made for the fabrication of an instrumented chain to make under-way measurements of thermal microstructure from the research vessel, and experimental measurements of radiation balance from the ship were carried out. (Author)

Climatology and Meteorology

Air Force Cambridge Research Center, Bedford, Mass.
AN INDEX OF IONOSPHERIC STORMINESS, by H. S. Marsh, W. H. Cameron, and R. A. Swirbalus. Dec 59, 22p. 3 refs. AFCRC-TR-59-365; AD-233 816.
Order from LC mi$2.70, ph$4.80 PB 146 358

An index of ionospheric storminess is needed to describe objectively the conditions of the ionosphere accompanying magnetic disturbances. Quiet-day recordings of the standard frequency transmissions from WWV and CHU are used to derive average monthly MUF (maximum usable frequency) and LUF (lowest usable frequency) contours. An index of storminess for a given day may be derived from the degree to which elevation of the LUF and depression of the MUF cause shrinkage of the average useful frequency spectrum for the day. Charts show the use of deviations from the average hours-in value for a given frequency to extrapolate equivalent percentage changes in MUF or LUF contours. Correlation with magnetic data is illustrated. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
MILITARY APPLICATIONS OF SUPERCOOLED CLOUD AND FOG DISSIPATION, by Currie S. Downie and Bernard A. Silverman. Dec 59, 51p. 117 refs. Air Force Surveys in Geophysics no. 118; AFCRC-TN-59-635; AD-234 550.
Order from LC mi$3.60, ph$9.30 PB 146 673

The physics of the dissipation of supercooled fog and stratiform clouds is examined briefly. The results of the Geophysics Research Directorate dry-ice seeding investigations are presented. Four seeding missions are discussed in detail as examples of the meteorological conditions to which the technique is applicable and the results which can be anticipated. On one mission the below-minimum weather conditions at destination were modified to allow a safe and routine VFR landing. Military and civilian applications include the clearing of weather at airfields for landings and takeoffs. (Author)

Air Force [Command and Control Development Div.] Bedford, Mass.
A NUMERICAL MODEL FOR THE PREDICTION OF HURRICANE FORMATION, by Louis Berkofsky. Mar 60, 100p. 102 refs. Geophysical Research Papers no. 67; AFCRC-TR-60-220.
Order from OTS $2.25 PB 161 889

A nongeostrophic flow model, in which the latent heat of condensation released through pseudo-adiabatic processes is the only heat source, is devised. An attempt is made to formulate initial conditions which resemble, as nearly as is known, the conditions existing prior to the formation of a hurricane. Using these initial conditions, the equations are solved on the IBM 704 electronic computer. Solutions are obtained with and without the latent heat of condensation in order to assess the importance of the heating for the development process. Solutions are obtained for three time steps (21 minutes). Even during this short period there are clear indications of the importance of latent heat. The vertical motions are about an order of magnitude larger, the horizontal temperature gradient is about one and one-half times as intense, and horizontal convergence is increasing much more rapidly, than when no heat is added. The pressure changes about the same amount in the case when heat is added as when no heat is added. This indicates a lag in the reaction of the pressure field to the addition of energy. It is estimated that the pressure field will react in 15 or 20 time steps. (Author)

Allied Research Associates, Inc., [Cambridge, Mass].
AN ESTIMATE OF THE POTENTIAL TRANSMISSION LOAD OF WEATHER RADAR DATA ON THE WEATHER SYSTEM 433L, by Robert C. Copeland. Scientific rept. no. 4 on Contract AF 19(604)5204. 14 Oct 59, 21p. 2 refs. AFCRC-TN-59-616; AD-233 825.
Order from LC mi$2.70, ph$4.80 PB 146 330

To evaluate the potential transmission load on the weather radar data handling portion of the weather system 433L without initiating an extensive radar climatology study, the average and maximum number of the weather radar network installations which would see precipitation at a given time was estimated from a consideration of the precipitation analyses of surface weather maps. Fifteen maps for each month from May 1958 to May 1959 were considered, and allowances were made for the typically lower altitudes and reflectivities of snow than of summer convective storms. Also, for 8 dates, the percentage of the area of each radar PPI scope that would be covered by precipitation echoes was estimated. The results suggest that 37% of the radar installations would be detecting precipitation at the given map time, on the average; however, it appears that as many as 75% of the radars would simultaneously detect precipitation of a few occasions. Although the echo coverage indicated on individual radar PPI scopes varied from zero to 100%, 20% or less coverage was dominant. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
A DESCRIPTION OF THE WINTER WEATHER AT THULE AIR BASE, GREENLAND, by David H. Slade. 15 May 59, 19p. USASRDL Technical rept. 2034; AD-216 880.
Order from LC mi$2.40, ph$3.30 PB 146 550

Most of the winter storms affecting Thule, an air base on the northwest coast of Greenland, originate as disturbances in the mid-latitudes. During their trip into the Arctic, their nature changes greatly. The effect of these storms at any particular location on the Greenland coast depends, to a great extent, on the local topography at that point and on the relationship between the position and path of the storm and the Greenland icecap. An investigation of surface stability and lapse conditions at Thule during the 1957-1958 winter shows some of the relationships between such structures and weather. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
HIGH ALTITUDE NIGHTTIME BALLOON ML-537( )/UM, by Moses Sharenow and Ruth M. Welt. 15 May 59, 12p. USASRDL Technical rept. 2031.
Order from LC mi$2.40, ph$3.30 PB 147 996

A high-altitude ballon, ML-537( )/UM, suitable for nighttime use has been developed and tested in temperate, tropic, and arctic latitudes. Results of the tests indicate that the balloon is capable of attaining a bursting altitude in excess of 100,000 feet with slightly more hydrogen than that required by existing night balloons now used to attain an altitude of 80,000 feet. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
A LIGHTNING COUNTER FOR POSITIVE AND NEGATIVE STROKES, by Lothar H. Ruhnke. 15 Apr 60, 24p. 4 refs. USASRDL Technical rept. 2111.
Order from LC mi$2.70, ph$4.80 PB 148 543

An electronic instrument is described which records on a strip chart recorder the rate of occurrence of lightning strokes, differentiating between positive and negative strokes. Two channels, one for the negative and one for the positive lightnings, are provided. The electrostatic component of a lightning is formed into an impulse of constant amplitude and length by means of a filter network and a monostable multivibrator. The pulses are integrated in a relay network and the result is recorded on paper. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
A MANUAL METHOD FOR SOLUTION OF THE HYDROSTATIC EQUATION, by Abraham Golden. 15 Jan 59, 13p. 3 refs. USASRDL technical rept. 2006; AD-226 687.
Order from LC mi$2.40, ph$3.30 PB 146 347

The development of an atmospheric sounding system, Rawin set AN/GMD-2, created a need for a manual method of computation for the hydrostatic equation of the atmosphere. A graphical and tabular method is presented when (1) the data are correlated values of geometric height, temperature, and humidity; and when (2) it is necessary to find the geopotential heights of standard-pressure surfaces and the pressure at a given geometric height. (Author)

Army Signal Research and Development Lab., Fort, Monmouth, N. J.
THE RECORDING OF ACOUSTIC WAVES FROM HIGH-ALTITUDE EXPLOSIONS IN THE ROCKET-GRENADE EXPERIMENT AND CERTAIN OTHER RELATED TOPICS, by William R. Bandeen. 1 July 59, 69p. 13 refs. USASRDL technical rept. 2056; AD-231 943.
Order from LC mi$3.90, ph$10.80 PB 147 997

The instrumentation and operation of the sound-ranging installation for the rocket-grenade experiment at Fort Churchill are discussed. Schrodinger's equation for the transmissivity of sound in the atmosphere is applied to empirical data illustrating the upper altitude limit of the experiment. A modified method of correcting for the finite-amplitude-propagation effect in the grenade experiment is discussed. An analysis is made of the specific problem of measuring angles of arrival of sound waves in the grenade experiment. The effect of the re-entry ballistic wave on grenade sound arrivals is discussed, and a method of determining the times of such obscured arrivals and also of weak sound arrivals is presented. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
RF FREQUENCY DRIFT OF RADIOSONDE TRANSMITTER T-435/AMT-4B, by A. A. Coppola. 15 May 59, 17p. USASRDL Technical rept. 2035.
Order from LC mi$2.40, ph$3.30 PB 146 549

This report illustrates the RF drift characteristics of Radiosonde Transmitter T-435/AMT-4B during a balloon flight and discusses the factors contributing to the general drift pattern. During a routine flight the radiosonde transmitter can be expected to drift in frequency by as much as 4.5 mc, the variation being from about 1 mc below to as much as 3.5 mc above the initial frequency. The RF drift can be attributed to two causes: temperature effects on the RF cavity, and a sharp decrease in battery filament voltage near the end of a flight, the latter having the greater effect. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
THEORY AND PERFORMANCE OF STREAMLINE NEOPRENE BALLOONS, by M. Sharenow. 15 Apr 59, 46p. 7 refs. USASRDL Technical rept. 2026; AD-220 785.
Order from LC mi$3.30, ph$7.80 PB 146 654

The theory of the motion of streamline balloons is developed in a manner analogous to that of spherical balloons. Ideally, expansible streamline balloons will accelerate continuously to burst if they do not reach the critical Reynolds number. In the case of the balloons investigated, this was reached near 50,000 feet where a sharp drop in ascent rate occurred. The ascent rate up to this altitude falls short of the theoretically computed rate because of balloon deformation and deviation from ideal shape. Comparison is made between two types of balloons. The newer one, fabricated by a new method known as the gel-adhered process, is lighter in weight and simpler to inflate and handle than the older type which is assembled by a cementing process. The two types provide approximately equivalent performance (75,000 feet at 1,800 feet per minute) when inflated with the same volume of gas. In practice, a smaller volume of gas is used to inflate the newer type, with an accompanying increase in bursting altitude and decrease in ascent rate. Methods of obtaining increased ascensional rates by roughening balloon surfaces in accordance with aerodynamic flow separation theory are suggested. (Author)

California U., Los Angeles.
TRANSOSONDE PROJECT, by M. G. Wurtele. Final rept. on Contract Nonr-233(21). 30 Sep 59, 19p. 14 refs. AD-228 833.
Order from LC mi$2.40, ph$3.30 PB 148 592

A study of the relation of the fields of pressure and wind are shown by an analysis of trajectories of transosonde balloons. The research included: (1) a complete synoptic study of the days of trajectory flights to be analyzed; (2) a theoretical study of the relation of the flight trajectory to the observed pressure field, and (3) an evaluation of the analytical and forecasting value of transosonde flight data in the absence of data from radio sonde and wind sonde networks. (Author)

Chicago U., Ill.
NAVY IMPROVEMENT IN FORECASTING, by H. Riehl. Final rept. for 1 Oct 51-30 Sep 59 on Contract N6ori-02036. [1959] 4p. 22 refs.
Order from LC mi$1.80, ph$1.80 PB 148 223

The main areas of interest were: (1) tropical circulations, especially hurricanes and typhoons; (2) general circulation of the tropics and coupling between low and high latitudes; and (3) jet streams, especially in the subtropics. The report lists 22 journal articles completed on this project.

Chicago, U., Ill.
SOME COMPUTATIONS OF THE INFLOW ANGLE IN HURRICANES NEAR THE OCEAN SURFACE, by Miriam Ausman. Rept. on Contract N6ori-02036. Sep 59, 22p. 3 refs. AD-228 931.
Order from LC mi$2.70, ph$4.80 PB 148 582

Ship wind reports around 6 hurricanes in 1954 and 1955 were used to obtain the inflow angle in these storms as a function of distance from the storm center and the angular distance from the direction of storm motion. The mean inflow angle averaged around radius circles seemed to be unrelated to the radius of the circle used or to storm maturity. The size and location of the areas of outflow, however, were well-defined at constant values. Outflow took place in an area about 140 angular degrees wide and approximately centered on the direction of storm motion. (Author)

Chicago U., Ill.
SYNOPTIC COMPARISONS OF JET STREAM AND GULF STREAM SYSTEMS, by Chester W. Newton. Technical rept. no. 1 on Contract Nonr-2121(10). Feb 59, 36p. 47 refs.
Order from LC mi$3.00, ph$6.30 PB 146 355

Comparisons are made between typical examples of oceanic and atmospheric current structures. These indicate that the lateral dimensions of the Gulf Stream are about 1/25 those of the jet stream; the shapes of the current profiles are almost identical, with equivalent lateral shears. In the vertical, the dimensions are nearly in the ratio 1:10, which also characterizes meander sizes. Striking similarities are found between thermal structures in the two systems. In both, variations from pronounced frontal concentrations to more gentle and broad barocline structures are observed over short distances or time intervals. Frontal slopes are equal, as are the vertical shears observed within frontal layers. Marked axial variations of speed, and of lateral and vertical gradients of current speed and temperature, are present in both systems. Ageostrophic motions are prominent. Some comments are made on possible interpretations of these variations, in regard to transverse circulations and to inertia oscillations in the current systems. (Author)

Laboratory of Climatology, Centerton, N. J.
INVESTIGATION OF THE HEAT AND WATER BALANCE AT CENTERTON, NEW JERSEY, MAY-JULY, 1959, by J. R. Mather and H. Hacia. Final rept. on Contract Nonr-1617(00). 1959, 52p. Publications in Climatology, v. 12, no. 1; AD-226 846.
Order from LC mi$3.60, ph$9.30 PB 147 182

Little, Arthur D., Inc., Cambridge, Mass.
WARM FOG AND STRATUS CLOUD DISSIPATION.
Final rept. on Contract DA 36-039-sc-64569.
4 June 56, declassified 28 May 57, 91p. 19 refs.
Order from LC mi$5.40, ph$15.30 PB 149 401

The investigations, both theoretical and experimental, have been directed toward the development of methods for dissipating warm fog and stratus clouds. Most of the work has been concerned with various possible electrical techniques for causing electrostatic precipitation of cloud particles and for promoting the formation of precipitation. Dissipation systems based on the evaporation of droplets have also been considered.

MacDonald Physics Lab., McGill U. (Canada).
THE MOTION AND EROSION OF CONVECTIVE STORMS IN SEVERE VERTICAL WIND SHEAR, by Walter Hitschfeld. Rept. on Contract AF 19(604)2065. July 59, 50p. 15 refs. Stormy Weather Research Group Scientific rept. MW-29; AFCRC-TN-59-447; AD-225 398.
Order from LC mi$3.30, ph$7.80 PB 146 536

Radar data displayed in the form of precipitation maps at constant altitude above ground were used to portray the structure of storms and their anvils. Well developed storms even in the presence of severe wind shear, were observed to remain essentially vertical through their active phase. Instead of being strongly bent by the shear, parts of the storm appeared to be carried off by the wind, forming extensive plume patterns or anvils which trailed down to levels as low as 10,000 ft while evaporating. Size and shape of the plume suggested that its particles had fall speeds ranging 0.75 to about 5 m sec^{-1}, and were of precipitation size. A statistical analysis of the precipitation patterns of two of the days analyzed is presented. This work includes a statistical measure of echo distribution as a function of height, and the derivation of a correlation index (probability of finding echo at a specified horizontal range and bearing from a point with echo). (Author)

Massachusetts Inst. of Tech., Cambridge.
ON THE PROBLEM OF INITIAL DATA FOR THE PRIMITIVE EQUATIONS, by Norman A. Phillips. Technical rept. on Numerical Weather Prediction Project, Contract Nonr-1841(18). Sep 59, 20p. 11 refs. AD-225 878.
Order from LC mi$2.40, ph$3.30 PB 148 578

An analysis is presented demonstrating that in a forecast with the primitive equations, pure geostrophic or purely non-divergent initial wind fields results in noticeable meteorological noise, especially in a baroclinic atmosphere. In a linear example this noise is shown to be suppressed if the divergence of the initial wind field is set equal to the divergence implied by the usual geostrophic theory of numerical weather prediction. The absence of noise in Charney's 1955 test computation with non-divergent balanced initial data is explained. The quasi-geostrophic expansion is used to define initial data for a non-linear forecast with the primitive equations. Two cases are considered; that where only the geopotential is known from observations, and that where only the non-divergent part of the wind is known from observation. The initial tendencies computed from initial data of this kind is shown to preserve the assumed geostrophic character of the flow, and making possible to get more accurate forecasts with the primitive equations. (Author)

Massachusetts Inst. of Tech., Cambridge.
QUESTIONS CONCERNING THE ENERGY OF STRATOSPHERIC MOTIONS, by Victor P. Starr. Scientific rept. no. 1 on Planetary Circulation Project, Contract AF 19(604)5223. Dec 59, 13p. 5 refs. AFCRC-TN-59-665; AD-233 568.
Order from LC mi$2.40, ph$3.30 PB 146 567

The theoretical conclusion is reached that the vertical transport of kinetic energy in the atmosphere from one horizontal layer to another is effected solely by an area integral multiplied by the vertical velocity. Speculations are made as to whether the kinetic energy in stratospheric levels is maintained against friction through such a vertical transport from other levels, or whether the needed supply is derived from convective sources in situ. (Author)

Massachusetts Inst. of Tech., Cambridge.
SOME RADAR OBSERVATIONS OF TROPOSPHERIC CELLULAR CONVECTION, by Reginald E. Newell. Research rept. no. 33 on Weather Radar Research, Contract AF 19(604)2291. Nov 59, 57p. 66 refs. AFCRC-TN-60-205; AD-233 832.
Order from LC mi$3.60, ph$9.30 PB 146 320

Small-scale cellular convection is a mode of motion whose role in the vertical transport processes in the troposphere is not established. The dimensions of cellular convective motions are obtained from a range-height display of a 3-cm AN/CPS-9 radar together with estimates of the frequency of cellular vs non-cellular echoes. The observation of cell spacing and depth, for cells which do not exceed about 6 km in depth, vary in a manner which is similar to that predicted from the Bénard cell theory of Lord Rayleigh. The motions may be transporting heat upwards. Other properties are doubtless simultaneously transported vertically; as an example, some estimates are made of the vertical flux of horizontal momentum at the radar site (42°N). (Author)

McGill U. (Canada).
TEMPERATURE AND WIND FREQUENCY TABLES FOR EURASIA. VOL. 1. JANUARY-MARCH, by J. N. Rayner. Rept. on Contract DA 19-129-qm-1447. Feb 60, 212p. Arctic Meteorology Research Group Pub. in Meteorology no. 18.
Order from LC mi$9.60, ph$33.30 PB 148 324

Naval Ordnance Test Station, China Lake, Calif.
CHARTS FOR DETERMINING ATMOSPHERIC DENSITY BETWEEN ALTITUDES OF 24,000 and 100,000 FEET, by Paul H. Miller. 18 Feb 59, 13p. NOTS TP 2184; NAVORD rept. 6464; AD-216 098.
Order from LC mi$2.40, ph$3.30 PB 146 681

Charts have been developed at the Naval Ordnance Test Station for the rapid and accurate determination of atmospheric densities between the pressure-altitude levels of 400- and 5-millibars in units of slugs per cubic foot. From these charts the density is determined as a function of pressure (in millibars) and temperature (in degrees Centigrade), with the assumption that the relative humidity is 0% at all levels under consideration. The range of densities considered is from 115 slugs/foot^3 x 10^{-5} to 40 slugs/foot^3 x 10^{-6}. These charts eliminate the necessity of mathematically computing atmospheric densities aloft for any combination of pressure and temperature typically encountered at the latitude of NOTS. (Author)

Naval Ordnance Test Station, China Lake, Calif.
HORIZONTAL-DISTANCE CALCULATOR FOR MAKING EARTH-CURVATURE CORRECTIONS IN RAWIN-DETERMINED UPPER-WIND MEASUREMENTS, by Paul H. Miller. Dec 59, 22p. 4 refs. NOTS TP-2387; NAVORD rept. 7021; AD-233 347.
Order from LC mi$2.70, ph$4.80 PB 146 729

A calculator, which incorporates earth-curvature features, has been developed and constructed for the determination of horizontal distances of a target at known altitude and elevation angle. The accuracy of the calculator is compared with other methods of obtaining the same information. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
FREQUENCIES AND DURATIONS OF HOURLY TEMPERATURES, FORT GREELY, BIG DELTA, ALASKA, by Fernand De Percin and Owen S. Parmele. Jan 60, 25p. 11 refs. Technical rept. EP-122; AD-234 283.
Order from LC mi$2.70, ph$4.80 PB 147 237

Naval Ordnance Test Station, China Lake, Calif.
TIME-VARIABILITY STUDY OF WINDS ALOFT AT THE NAVAL ORDNANCE TEST STATION, CHINA LAKE, CALIFORNIA, by Paul H. Miller. 1 Oct 55, 69p. 7 refs. NOTS-1274; NAVORD Rept. 4952.
Order from LC mi$3.90, ph$10.80 PB 148 045

The results of this study form a useful tool for the weather forecaster and for use in scheduling tests requiring certain upper wind parameters. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
THE MEASUREMENT AND SIGNIFICANCE OF DEW, by William C. Robison. Sep 59, 20p. 30 refs. Research Study rept. RER-28; AD-230 370.
Order from LC mi$2.40, ph$3.30 PB 146 468

Dew is a micrometeorological phenomenon that was studied sporadically in many countries. Methods of measuring amounts of dew at observing stations are not standardized on a world basis or within the U. S. For laboratory study, drosometers, based on the difference in weight of a receptor before and after exposure, are most suitable, and are often used in conjunction with a recording cylinder. For observations at field stations, an optical method has considerable advantages. (Author)

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
DETERMINATION OF THE MODULUS OF ELASTICITY OF ARTIFICIAL SNOW-ICE IN FLEXURE, by Leif K. Halvorsen. Master's thesis. Feb 59, 27p. 5 refs. Research rept. 31; AD-216 681.
Order from LC mi$2.70, ph$4.80 PB 148 474

This study was initiated to determine the modulus of elasticity for artifical snow-ice, and to arrive at some method of making flexural tests on snow and ice. The testing was done at the Keweenaw Field Station, Houghton, Michigan. Fifty-eight snow-ice beams were tested with variation in density and loading rate. Results show that both loading rate and density influence the value of the modulus of elasticity (E). A variation in density from 0.621 to 0.719 g/cm^3 gave a variation of E from 1.35 x 10^4 to 2.22 x 10^4 kg/cm^2. A variation in the relative time of deflection from 42 sec/0.0200 to 23 sec/0.0200 cm gave a variation of E from 1.22 x 10^4 to 1.45 x 10^4 kg/cm^2. The modulus of rupture was found for different conditions and the effect of the density variation computed. For the density range studied, the modulus of rupture varied from 7.79 to 11.54 kg/cm^2. The failure appeared to be a combination of shear and flexure. (Author)

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
RECOMMENDED STANDARDS FOR SMALL-SCALE ICE STRENGTH TESTS, by T. R. Butkovich. Nov 58, 9p. 4 refs. Technical rept. 57, AD-211 569.
Order from LC mi$1.80, ph$1.80 PB 146 560

The effects of specimen size and shape on the strength values obtained with small-scale unconfined compressive tests are shown. Results are given that show that a loading rate of 0.5 kg/cm^2-sec is required for all small-scale strength tests to minimize plastic effects which accompany slow loading of ice. The ring test, which is a useful new type of test to measure the tensile strength of ice, is described. Recommended standards for specimen size, shape, and configuration along with loading rates and equipment are discussed. (Author)

Army Snow, Ice and Permafrost Research Establishment, Wilmette, Ill.
SOME PHYSICAL PROPERTIES OF ICE FROM THE TUTO TUNNEL AND RAMP, THULE, GREENLAND, by T. R. Butkovich. May 59, 21p. 7 refs. Research rept. 47; AD-225 569.
Order from LC mi$2.70, ph$4.80 PB 148 475

Strength, density, elasticity, crystal size, bubble size, and fabric of the ramp ice and 5 types of tunnel ice were studied, and ice temperatures and ceiling deformation in the tunnel were measured. Crushing and ring tensile strength tests were made in a tunnel room at -5C on cylindrical cores (3 in. diam and 9 in. long) taken horizontally and vertically in the tunnel and vertically in the ramp, and flexural strength was

measured on horizontal and vertical beams from both the tunnel and the ramp. The crushing strength of tunnel ice showed slight differences among ice types, but not between horizontal and vertical samples. and fitted the empirical equation relating crushing strength to density. The equation did not hold for ramp ice of average density, probably because of layering. The results of ring tensile tests were similar to those of crushing t sts, except that the equation relating ring tensile strength to the density of high-density snow gave values about 20% higher than for tunnel ice. The flexural strength of ramp ice was about half that for tunnel ice and comparable to. but consistently lower than, ring tensile values. The static modulus of elasticity was about 1/5 the average dynamic modulus, and increased with increasing rate of load application, approaching the value of the dynamic modulus as a limit. Lower values of the static modulus were observed for ramp ice. Deformation studies in a tunnel room (100 x 30 ft) indicated that the room is closing primarily by a block action. (Author)

Denver U., Colo.
GLACIOLOGICAL INVESTIGATIONS IN THE TUTO AREA OF GREENLAND, by T. M. Griffiths. Final rept. on Ramp Studies in Thule Area, Contract DA 11-190-ENG-20. Apr 60, 72p. 7 refs. Technical rept. 47.
Order from LC mi$4.50, ph$12.30 PB 149 123

This report is primarily concerned with work accomplished during the 1956 field season, but observations and data obtained in 1954 and 1955 are included in many cases.

Naval Civil Engineering Lab., Port Hueneme, Calif.
STRAIN GAGE TECHNIQUE FOR DYNAMIC MEASUREMENT OF ICE, by Don B. Clark. Interim rept. 18 Feb 60, 21p. Technical rept. 060; AD-235 057.
Order from LC mi$2.70, ph$4.80 PB 146 971

The Laboratory is undertaking a study of the properties of sea ice. A technique for applying resistance wire strain gages to ice samples for dynamic measurement of strain has been developed to facilitate this study. A coating was found which would maintain the high electrical impedance necessary between the strain gage and sea ice samples. Strain gages were applied to various samples of fresh water and sea water ice. These were compression-loaded dynamically to failure while the strain was recorded with an oscillograph and bridge amplifier. Sufficient strain data was recorded to indicate the validity of the new technique. Under rapid compression loading to a point near failure of the ice, a strain gaged ice sample can be cycled without permanent deformation or flow of the ice, and without slippage of the gage. Gages properly coated are shown to hold their high electric impedance against sea water ice for a period of time exceeding three weeks. Resistance wire strain gages, with proper preparation and application, can be used advantageously to measure the dynamic strains in fresh water ice or sea ice, and thus determine their structural characteristics. (Author)

Geography

Arctic Inst. of North America, Washington, D. C.
NORTHERN ELLESMERE ISLAND: CAPE ALDRICH TO CAPE COLGATE, NORTHWEST TERRITORIES, CANADA, by James R. Lotz. Scientific rept. no. 1 on Contract AF 19(604)3073. Apr 59, 101p. 54 refs. Publication no. 1; AFCRC-TN-60-274.
Order from LC mi$5.70, ph$16.80 PB 148 221

This report deals with location and extent; exploration; topography of Cape Aldrich, Cape Columbia, Cape Columbia to Disraeli Bay, Disraeli Fiord and Ward Hunt Island, Cape Discovery, M'Clintock Fiord, Cape Richards, Ayles Bay, Yelverton Fiord, Phillips Bay to Yelverton Fiord, Phillips Bay, and Phillips Bay to Cape Colgate; ice features along the coast; traveling conditions along the coast of Northwest Ellesmere Island, including weather, climate, and scientific work determined by Aldrich, Peary, Marvin, the 1953,. and the 1954 expeditions; times of beginning and ending of the melt; regional and structural geology; geomorphology and glaciation; vegetation; and wild life.

California U., Los Angeles.
TRANSPORTATION AND PHYSICAL GEOGRAPHY IN WEST AFRICA, by Benjamin E. Thomas. Technical rept. no. 2 on Human Environments in Central Africa Proje.., Contract DA 19-129-qm-1309. 1960, 58p. 23 refs.
Order from LC mi$3.60, ph$9.30 PB 147 939

This report includes a set of 12 original maps showing the monthly changes in usable roads and waterways in French West Africa. Because data have already been collected on roads and inland waterways, these routes receive special attention, and items for which material is not at hand, such as ports, seaways, and airways, are omitted. French West Africa was selected as the focus of the study because it reaches from the heart of the Sahara to the Guinea Coast and extends over all the major types of physical areas that are found in West Africa.

National Research Council, Washington, D. C.
THE KABUL, KUNDUZ, AND HELMAND VALLEYS AND THE NATIONAL ECONOMY OF AFGANISTAN. A STUDY OF REGIONAL RESOURCES AND THE COMPARATIVE ADVANTAGES OF DEVELOPMENT, by Aloys Arthur Michel. Rept. no. 5 on Foreign Field Research Program, Contract Nonr-2300(09). 1959, 460p. 67 refs. AD-225 909.
Order from LC mi$11.10, ph$69.60 PB 148 602

Contents:
Regional studies
- The Kabul Valley
- The Kunduz Valley and related areas
- The Helmand Valley: geographical and historical setting
- The Helmand Valley: the project areas along the Helmand
- The Helmand Valley: the project areas along the Arghandab

Hydroelectric, industrial and commercial features of the Helmand Valley project
Evaluation of the Helmand Valley project within its own region
Interregional analysis
The direction of Afghan economic development
The location of Afghan economic development
Power resources and requirements of industrial development
Transportation resources and requirements of development
The three regions and the national economy of Afghanistan

Oceanography

Marine Lab., U. of Miami, Coral Gables, Fla.
A DATA REPORT OF FLORIDA GULF COAST CRUISES, by Frank Chew, S. J. Bein and J. H. G. Stimson. Rept. on Contract Nonr-840(01). June 59, 121p. Rept. 59-1; AD-220 751.
Order from LC mi$6.30, ph$19.80 PB 146 704

This DATA REPORT contains hydrographic and chemical data collected during the 8 major cruises sponsored by the Florida State Board of Conservation during the two-year period beginning July 1955. The data for each station are reported in two parts. The first part, entitled BATHYTHERMOGRAPH OBSERVATIONS, give the date, hour, location and depth of station, sea surface temperature, wind, and air temperature; the bathythermograph instrument number is given for some cruises, in others, the surface salinity (or the sample number for surface salinity) is given. The second part contains the salinity, phosphorus, nitrate and nitrite at the indicated depths. Where pertinent, surface water movements as determined by the GEOMAGNETIC ELECTROKINETOGRAPH (GEK Current), von Arx, W. S. 1950, (An electromagnetic method for measuring the velocities of ocean currents from a ship under way, Pap. Phys. Oceanogr. Meteor. 11(3); 1-62), are also included. Serial numbers of drift tubes are included for one cruise to show the method of recording.

Marine Lab., U. of Miami, Coral Gables, Fla.
RECONNAISSANCE SURVEY OF THE BATHYMETRY OF THE STRAITS OF FLORIDA, by Violet B. Siegler. Technical rept. on Contract Nonr-840(01). June 59, 18p. 15 refs. Rept. 59-3; AD-227 264.
Order from LC mi$2.40, ph$3.30 PB 146 702

The area of the Straits of Florida surveyed in this report extends from approximately 27°15' N (St. Lucie Inlet) along the Florida coast to 24°30' N (the area of Key West) and from 81°50' W to the Grand Bahama Bank. This swath of water extends roughly 250 miles from the above-mentioned north and south points and varies from 40 to 90 miles in width.

Naval Ordnance Test Station, China Lake, Calif.
DEEP-SEA TEMPERATURE METER, by Hugh B. Martin, III and George R. Lewis. 8 Sep 59, 20p. NOTS TP-2321; NAVORD rept. 6589; AD-234 963.
Order from LC mi$2.40, ph$3.30 PB 146 986

An electronic, frequency-modulated instrument for the continuous measurement of ocean temperature was designed. Pressure, velocity of sound propagation, and other parameters can be measured and recorded simultaneously. This transistorized meter is small and easy to handle, covers a temperature range of 0 to 30°C with a sensitivity of 0.01°C and an accuracy of 0.03°C, and operates in the frequency range of 5,000 to 8,000 cps. (Author)

New York U. Coll. of Engineering, N. Y.
A STUDY OF WAVE FORECASTING METHODS AND OF THE HEIGHT OF A FULLY DEVELOPED SEA ON THE BASIS OF SOME WAVE RECORDS OBTAINED BY THE O. W. S. WEATHER EXPLORER DURING A STORM AT SEA, by Willard J. Pierson, Jr. Technical rept. on Contract Nonr-285(03). June 59, 34p. 18 refs. AD-220 419.
Order from LC mi$3.00, ph$6.30 PB 146 694

The growth of the waves in a storm in which the wind speed increased from 25 kn to 62 kn and in which the significant waves grew 6 ft to 42 ft as recorded by the O. W. S. Weather Explorer is studied. Spectra computed from the records are compared with results of Darbyshire and Neumann. The spectral forms given by Neumann for partially developed seas do not agree with the observed spectra, although the height forecasts are good. The results indicate that the height of a fully developed sea as a function of wind speed as given by Neumann is an overestimate. They also suggest that the data studied by Darbyshire do not correspond to fully developed seas for the higher wind speeds and that the height of a fully developed sea as given by Darbyshire is an underestimate. (Author)

Scripps Institution of Oceanography, U. of California, La Jolla.
IMPULSIVELY GENERATED WAVES, by William G. Van Dorn. Rept. no. 2 on Contract Nonr-233(35). 12 Aug 59, 80p. 28 refs. AD-225 953.
Order from LC mi$4.50, ph$12.30 PB 148 181

The prediction of the local effects from long period water waves incident upon an arbitrary coastline is approached on a dimensional basis for lack of an adequate hydrodynamic theory. A model for wave runup and shoreline height on a sloping beach is constructed by extrapolating the results of laboratory experiments. The model leads to predictions in satisfactory agreement with field observations of local effects from two large tsunamis. Curves are provided for predicting local offshore wave height and length from an arbitrary source of known energy, as well as local effects in terms of the offshore height. The predictions are considered to be accurate within a factor of 1.8 (70% probability). An attempt is made to construct prediction curves for tsunamis based on wholly seismic evidence by analogy to waves from explosions, but the results are indeterminate, since they depend upon a knowledge of the focal depth of earthquakes. It is concluded that a chain of long-wave stations on selected small islands could give ocean-wide advance warning of dangerous tsunamis, and quantitative predictions of local effects in critical areas. (Author)

Air Force Cambridge Research Center, Bedford, Mass.
DESIGN WIND PROFILES FROM JAPANESE RELAY SOUNDING DATA, by Norman Sissenwine, Matthew T. Mulkern (Wolf Research and Development Corp.) and Henry A. Salmela. Dec 59, 37p. 14 refs. Air Force Surveys in Geophysics no. 117; AFCRC-TR-59-292; AD-234 551.
Order from LC mi$3.00, ph$6.30 PB 147 444

The best balloon-measured upper winds over Japan are the Tateno relay soundings, a special series of observations especially developed to provide an accurate sounding capability for this area. From these soundings (which are corrected for the curvature of the earth), only those in which a wind speed at either 3, 6, 9, 12, or 15 km exceeds the values achieved 99 and 95% of the time were selected. Profiles, both synthetic and typical, exhibiting general characteristics common to these high-speed cases, are presented. Directional changes accompanying the wind shears are found to be small in the majority of the soundings. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
ATMOSPHERIC NET-RADIATION FLUX DURING WINTER IN THE THULE AREA, GREENLAND, by Robert W. Fenn and Helmut K. Weickmann, 4 Jan 60, 13p. 4 refs. USASRDL technical rept. 2090; AD-230 757.
Order from LC mi$2.40, ph$3.30 PB 148 001

A brief description of an airborne IR net-radiation receiver (developed in Germany) is given. The results of 2 radiosonde flights made with this element at Thule Greenland, on 14 and 15 Feb 1959 are shown. The outgoing net-radiation flux increases with altitude from 0.05 cal cm^{-2} min^{-1} at the surface to about 0.2 cal cm cm^{-2} min^{-1} between 10,000 and 20,000 m. Above 25,000 m the outgoing net-radiation flux again decreases considerably. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
FIELD OPERATION OF ROCKET-GRENADE ATMOSPHERIC SOUNDING SYSTEM, by Milton Berdan. 15 Feb 60, 42p. USASRDL Technical rept. 2096.
Order from LC mi$3.30, ph$7.80 PB 148 540

This report provides a description of the installation and operation of the instrumentation system used for the rocket-grenade atmospheric sounding experiments conducted on the Island of Guam during October and November 1958. This report describes only the instrumentation, system, and equipment used, and does not deal with the data acquired or the reduction and evaluation of these data. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
HIGH ALTITUDE RADIOSONDE FLIGHTS, 1956. PART IV, by Marvin Lowenthal and A. Arnold. 15 Mar 59, 231p. 6 refs. USASRDL technical rept. 2018; AD-226 686.
Order from LC mi$10.20, ph$36.30 PB 146 391

The 1956 series of Signal Corps cooperative high-altitude radiosonde flights is described. Temperature and wind data were analyzed, and the results are discussed. The monthly data for 8 locations in North America are presented for January and July 1956, as well as cross sections along the east and west coasts for the same months. (Author) (See also PB 138 430)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
MEASUREMENT OF ELECTRIC FIELD, AIR-EARTH CURRENT, AND CONDUCTIVITY, by Joseph J. Kreig. 1 Dec 59, 14p. 4 refs. USASRDL technical rept. 2085; AD-231 864.
Order from LC mi$2.40, ph$3.30 PB 148 000

Instrumentation for measuring, simultaneously, the three basic atmospheric electric elements-electric field, air-earth current, and conductivity-is described. The apparatus includes an automatic switch which allows a micro-microammeter to monitor four inputs, and a multi-point recorder for registering the data on a single chart. The instrumentation has operoperated for extended periods in the Arctic with a nominal amount of maintenance. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
MEASUREMENT OF THE CONCENTRATION AND SIZE DISTRIBUTION OF PARTICULATES IN THE ARCTIC AIR OF GREENLAND, by Robert W. Fenn. 15 Feb 60, 14p. 12 refs. USASRDL Technical rept. 2097; AD-237 035.
Order from LC mi$2.40, ph$3.30 PB 148 541

A series of aerosol measurements at a remote site on the Greenland Icecap (Fist Clench, 210 miles east of Thule Air Force Base) was conducted during August 1959 in order to determine the concentration and the size distribution of the natural aerosol in air which is free of direct contamination from the soil or any human activity. Analyses made with a Goetz Aerosol Spectrometer and a particle cascade impactor show concentrations between 1 and 3 particles per cm^3 and a very narrow size spectrum of 1 micron $\pm$ 0.1 micron diameter Some aspects for a possible explanation of this very distinct and characteristic aerosol distribution are discussed. (Author)

California U., Los Angeles.
SCATTERING PROPERTIES OF ATMOSPHERIC AEROSOLS, by Robert S. Fraser. Scientific rept. no. 2 on Light in the Atmosphere, Contract AF 19(604)2429. Oct 59, 189p. 57 refs. AFCRC-TN-60-256; AD-233 288.
Order from LC mi$8.40, ph$28.80 PB 146 645

The purpose of the presented study was to determine the intensity and polarization of light scattered by a unit volume of an atmospheric aerosol, for different models of size distribution of aerosol particles. The four polarization parameters were expressed in terms of the four Stokes parameters. Each of the four polarization parameters showed an appreciable dependence on each of the three size distributions of atmospheric aerosol models and on the wave length of the incident light. The total intensity is the only polarization parameter for atmospheric aerosols which has been measured. Measured values of the total intensity of light scattered by atmospheric aerosols were found to be similar to those computed for different models. A normalized scattering matrix was computed for each of the three aerosol models. By introduction of one of these matices into the equation of radiative transfer for a turbid atmosphere, a numerical solution can be obtained in principle. However, numerical computations of the solution become practical only if the number of terms in the series of the matrix elements is reduced. To reduce the number of these terms, it is necessary to introduce restrictive assumptions either into the law of scattering or into the model of size distributions of aerosol particles, or into both.

Electrical Engineering Research Lab., U. of Texas, Austin.
AN EXPENDABLE ATMOSPHERIC RADIO REFRACTOMETER, by A. P. Deam. Rept. on Contract Nonr-375(08). 15 May 59, 36p. 3 refs. Rept. no. 108; AD-217 261.
Order from LC mi$3.00, ph$6.30 PB 146 586

This report describes a device which has been designed to measure atmospheric index of refraction profiles at a frequency of 403 mc. It is a prototype instrument and should be capable of ejection from an aircraft as well as elevation with a balloon. Transmitted frequency is received at a receiver whose recorded output is relative radio index of refraction. This instrument has been successfully tested in a balloon flight to elevations of the order of 60,000 feet. (Author)

Ionosphere Research Lab., Pennsylvania State U., University Park.
ELECTRON DENSITIES IN THE UPPER IONOSPHERE FROM ROCKET MEASUREMENTS, by John S. Nisbet. Scientific rept. no. 126 on Ionospheric Research, Contract DA 36-061-ORD-577, 10 Dec 59, 176p. 77 refs. AD-234 128.
Order from LC mi$8.10, ph$27.30 PB 147 249

An investigation of electron densities in the upper F region of the ionosphere by new techniques employing long range rockets is described. Investigations were confined to propagation measurements between the missiles and ground stations, and to methods not requiring radio links with the missile in addition to those already incorporated for telemetry and tracking purposes. The vehicles were limited to those with satellite launch missions, and to IRBM's. Since such vehicles have considerable horizontal velocity components, suitable methods of analysis were developed. A matrix method is described for analyzing oblique dispersion measurements to provide vertical electron density height profiles. In this method account is taken of horizontal gradients, refraction, and the varying ray path zenith angles in the ionosphere. Two methods of measuring ionospheric dispersion were compared: Faraday rotation, and a method using the difference between the apparent positions of the missile obtained by 2 tracking systems operating on different frequencies. (Author)

Johannes Gutenberg-Universität, Mainz (West Germany).
ON THE HEAT BALANCE OF THE TROPOSPHERE, by Fritz Kasten, Gunther Korb and others. Final rept. on Contract AF 61(052)18. Jan 59, 123p. 19 refs. AFCRC TR-59-234; AD-232 639.
Order from LC mi$6.30, ph$19.80 PB 146 300

A study is summarized on the radiation balance of the troposphere that was begun in 1955 and is led now to a provisional conclusion. Theoretical foundations are given to calculate the synoptic distribution of the tropospheric radiation balance for single days. The resulting values are averaged with respect to large scale weather situations. The results of the months investigated are represented in maps. Charts of cloudiness and total water vapor content of the troposphere are enclosed for direct comparison. The maps of absorption, emission and tropospheric radiation balance show regions of high and low values of the respective quantities. High values of the tropospheric radiation balance mean considerable energy loss of the troposphere caused by radiative processes, vice versa. For all regions investigated maximum values of the tropospheric radiation balance are found during November and amount to 250 - 300 cal $cm^{-2}d^{-1}$. Minimum energy loss, expressed by small values of the radiation balance, results for the period from May until July with values of 140 - 190 cal $cm^{-2}d^{-1}$. (Author)

Ohio State U. Research Foundation, Columbus.
FLIGHT TEST RESULTS FOR ML-419 RADIOSONDE TEMPERATURE ELEMENTS MODIFIED TO REDUCE RADIATION ERRORS, by John H. Snow. Technical rept. no. 4A on Contract DA 36-039-sc-78153. Dec 59, 67p.
Order from LC mi$3.90, ph$10.80 PB 148 549

Fourteen balloon flights were made to compare the indicated temperatures of regular ML-419 elements and modified elements. The results and conclusions from these flights are summarized: (a) Nighttime flights: unshielded metal-coated elements have smaller radiation errors than the ML-419 element now in use; aluminum- or gold-coated elements are about equally effective at night; properly shielded metal-coated elements may have less error than unshielded elements. (b) Daytime flights: the modified elements, in all cases surrounded by radiation shields, were cooler than the ML-419 elements at low altitudes (up to 60,000 ft.) and became progressively warmer at higher altitudes; the arrangement which gave the best results was a white-painted 10-inch shield with an aluminum-coated element.

Ohio State U. Research Foundation, Columbus.
METHODS FOR REDUCING THE RADIATION ERROR OF THE ML-419 RADIOSONDE TEMPERATURE ELEMENT AT ALTITUDES UP TO 150,000 FEET, by John H. Shaw. Technical rept. no. 4 on Contract DA 36-039-sc-78153. June 59, 63p. 10 refs. AD-228 264.
Order from LC mi$3.90, ph$10.80 PB 148 548

The factors which influence the radiation error of the ML-419 Temperature Element have been evaluated. It is concluded that a significant reduction in the daytime and nighttime radiation errors of such elements is most likely to be achieved by coating the element with a highly reflecting metallic surface such as polished aluminum. This element should be placed inside a thin-walled radiation shield, black to all radiation on the inside, and a good scatterer of solar radiation and a good emitter of thermal radiation on the outside. The shield should be open at the top, and the element should be placed at such a depth that it rarely receives direct sunlight and is not in the path of air which has had thermal contact with the sides of the shield. Calculations indicate such a system should have a radiation error of less than ±0.5°K at all altitudes to 130,000 ft. (Author)

Stanford Research Inst., Menlo Park, Calif.
UPPER ATMOSPHERE CLUTTER RESEARCH. PART I. VHF AND UHF AURORAL INVESTIGATIONS AT COLLEGE, ALASKA, by R. I. Presnell, R. L. Leadabrand, and others. Final rept. pt. 1, on Contract AF 30(602)1762. Apr 59, 88p. 8 refs. SRI Proj. 2225; RADC-TR-59-34; AD-211 937.
Order from LC mi$4.80, ph$13.80 PB 147 131

The results of radar investigations of the aurora at frequencies of 216, 398, and 780 mc are presented. The characteristics of the echoes that have been recorded are range, depth in range, bearing, elevation angle, height, strength, times of occurrence, duration of echoes, and polarization effects. Two distinct types of echoes have been shown to exist, discrete and diffuse. They differ mainly in that the discrete echoes occur at night and the diffuse echoes occur during the day, and the diffuse echoes arise from a much larger reflecting region than the discrete echoes. The echoes have been compared with visual aurora, magnetic activity, earth potentials, 41-mc auroral radar data, and auroral absorption. An indication of the aspect sensitivity of the auroral reflections has been obtained. Crude estimates of the wavelength dependence of reflected echo power have been obtained for the reflections using nonsimultaneous data at 3 frequencies. (Author)

Stanford Research Inst., Menlo Park, Calif.
UPPER ATMOSPHERE CLUTTER RESEARCH. PART III: RUSSIAN EARTH SATELLITES 1957 ALPHA AND BEAT RADIO AND RADAR DATA AND A SIMPLE SATELLITE POSITION PREDICTION TECHNIQUE, by W. E. Jaye and L. H. Rorden. Final rept. part 3 on Contract AF 30(602)1762. May 59, 66p. 6 refs. RADC-TN-59-45; AD-212 618.
Order from LC mi$3.90, ph$10.80 PB 147 025

The technique is based on equations derived for circular orbits; it is assumed that the earth is a spherically symmetrical body, that the satellite has a negligible mass, and that there are no drag forces. These equations were used to successfully predict the position of the satellite on a day-to-day basis, and to point the radar beam at the path of the satellite. Included is a description of the Doppler-frequency measuring technique and estimates of the accuracy of the measurements. The accuracy was considered to be quite good, in view of the simple equipment used. Generally, errors in the maximum slope of the Doppler-frequency-time curve were less than 5%, and in the time of closest approach less than ±15 seconds. The equations used to relate satellite position to Doppler data are developed and discussed. Analysis of the accuracy of the equations shows that the calculated results are of about the same order of accuracy as the experimental data. (Author)

Stanford Research Inst., Menlo Park, Calif.
UPPER ATMOSPHERE CLUTTER RESEARCH. PART VII. DOPPLER INVESTIGATIONS OF THE RADAR AURORA AT 400 MC, by R. L. Leadabrand, R. L. Presnell and others. Final rept. pt. 7, on Contract AF 30(602)1762. Mar 59, 47p. 11 refs. SRI Proj 2225; RADC-TR-59-50; AD-213 581.
Order from LC mi$3.30, ph$7.80 PB 147 150

Using a relatively sensitive 400-mc radar located at College, Alaska, the variation of Doppler shift of auroral echoes has been determined as a function of the following parameters: (1) Azimuth angle of the radar ray, (2) Off-perpendicular intersection angle of the radar ray and the earth's magnetic field, (3) Elevation angle of the radar ray, (4) Range of the echoes, (5) Altitude of the reflection centers, (6) Time of day, (7) Number of occurrences, and (8) Amplitude of the echoes. These data have been further delineated in terms of the type of echo seen (discrete or diffuse) and whether or not the data were taken before or after magnetic midnight. An estimate of the spectrum spread of auroral echoes has been determined by pulse and CW techniques. A consistent trend in these data has been found which indicate an East-West motion of the ionospheric irregularities. There is no appreciable variation in the direction of motion with time of day or with respect to magnetic midnight. The mean velocity of the East-West motion appears to be about 500m per sec. (Author) (See also PB 147 025)

ENGINEERING

Dynamic Analysis and Control Lab., Mass. Inst. of Tech., Cambridge.
BASIC RESEARCH AND DEVELOPMENT IN FLUID POWER CONTROL FOR THE UNITED STATES AIR FORCE, by J. Lowen Shearer. Progress rept. no. 2, 1 Feb-31 May 59, on Contract AF 33(616)6120. [1959] 48p. 7 refs. WADC Technical rept. no. 59-491.
Order from LC mi$3.30, ph$7.80 PB 149 285

This report describes continuing applied research and development work on vital problems encountered in providing high performance hydraulic and pneumatic control systems for advanced system design and development. Increased emphasis on high pressure pneumatic components and systems reflects approach to an ultimate objective of employing hot gas power to operate such systems. Control valves, servomotors, gas bearings, and techniques of control are the major items discussed in this report. (Author)

Aeronautical Accessories Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
THE EFFECTS OF CABIN ATMOSPHERES ON COMBUSTION OF SOME FLAMMABLE AIRCRAFT MATERIALS, by Howard A. Klein. Rept. on Aircraft Environmental Control. Apr 60, 32p. WADC Technical rept. 59-456.
Order from OTS $1.00 PB 161 841

The effects of varying atmospheric conditions on the combustion of certain flammable materials creating fire hazards in aircraft were measured in a test chamber. Atmospheric compositions used were pure oxygen and oxygen-nitrogen and oxygen-helium mixtures in various proportions. Pressures varied from sea level to 25,000 ft altitude. Flammable materials tested included cotton cloth, 8 samples of aircraft wire, and aircraft fluids including JP-4 fuel, hydraulic fluids, and lubricating oils. Test data indicates the burning rate or ignition temperatures for each type of material under specific atmospheric conditions. Plots of the data illustrate the trends shown by the test results. (Author)

Aeronautical Structures Lab., Naval Air Material Center, Philadelphia, Pa.
EVALUATION OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT) MULTI-SHAKER VIBRATION EQUIPMENT FOR CONDUCTING GROUND VIBRATION SURVEYS OF NAVAL AIRCRAFT (PHASE A) by Warren W. Yenney, Jr. and G. Borod. 15 Nov 50, 45p. Rept. no. ASL NAM DE-244, pt. 1.
Order from LC mi$3.30, ph$7.80 PB 146 464

The Massachusetts Inst. of Tech. (M. I. T.) multi-shaker equipment has been evaluated for conducting ground vibration surveys of naval aircraft by employing it to obtain the vibration characteristics of a standard service type F7F-3N airplane. The report describes the methods used in supporting the shakers and attaching them to the various aircraft components as well as the general testing procedures. Since it is intended that this report serve as an example of the types of information that may be obtained with the equipment, sufficient photographs, plates, and records have been included to aid in explaining the methods employed in these tests to prospective users of this equipment.

Air Force Missile Development Center, Holloman AFB, N. Mex.
SEALED CABIN ATMOSPHERE PROBLEMS, by Erwin R. Archibald and David G. Simons. Dec 59, 19p. 6 refs. AFMDC-TR-59-42.
Order from LC mi$2.40, ph$3.30 PB 146 356

Certain physiologic problems encountered in the design and operation of hermetically sealed cabins have been discussed. Known parameters which limit human performance were presented, along with a discussion of atmospheric environmental factors as to upper and lower limits for a flight of 24 hours duration, where conditions of "no performance decrement" are desired. Parameters discussed included: inspired carbon dioxide partial pressure, alveolar oxygen partial pressure, and total cabin pressure. (Author)

Airborne Instruments Lab. [Deer Park] N. Y.
ALTIMETERS FOR LOW ALTITUDE AND FLARE-OUT: AN INVESTIGATION OF THE STATE OF THE ART AND EQUIPMENT AVAILABILITY, by E. N. Hooton and T. C. Wellington. Rept. on Task 17, Contract FAA/BRD-16. June 59, 44p. 27 refs. Rept. no. 5791-17.
Order from OTS $1.25 PB 161 854

Increasing demands for all-weather landing capability require a study of the state of the art in the field of altimetry, with emphasis on these altimeters suitable for low-altitude and flareout. The three primary techniques used in the design of absolute altimeters are CW (radio), pulse (radar), and sonic (operating in the AF range). Subject to certain reservations--due to lack of established flareout criteria--it is concluded that quantized FM/CW techniques can meet the present low-altitude and flareout requirements. By mid 1960 there will be a choice of equipments. With the likelihood of higher accuracy requirements in the future, it is probable that non-quantized CW altimeters will be used more extensively. Currently under development, this equipment will be phased into service by the end of 1960. If extensive development of radio altimeters exhausts the possibility of further substantial improvement in performance, the capabilities of pulse radar altimeters may prove attractive. Present development shows that a high degree of accuracy is possible with light-weight equipment. Sonic altimeters have not found favor in the past because of poor signal-to-noise characteristics. Although the sonic CW altimeter shows promise, this equipment is not likely to be universally applicable. (Author)

Airborne Instruments Lab. [Mineola] N. Y.
RUNWAY CHARACTERISTICS AND PERFORMANCE OF JET TRANSPORTS IN ROUTINE OPERATION, VOLUME I. Rept. for 20 June-11 Nov 59 on Task 15, Contract FAA/BRD-16. Mar 60, 104p. Rept. no. 5791-15.
Order from OTS $2.50 PB 161 856-1

A measurement program has been completed to determine the characteristics and performance of jet aircraft during landings and takeoffs. Data were obtained by photographing the displays of the Airport Surface Detection Equipment (ASDE) radar at New York International Airport (Idlewild), with proper time and identification references. Techniques of data reduction and statistical analysis were developed to determine jet aircraft characteristics and performance. The results of this analysis as well as the data will be useful in various airport research programs, for they comprise a comprehensive record of routine airline operations during various wind and temperature conditions. In addition, the data can be used in the analysis of aircraft performance to determine runway length criteria, and acceleration and deceleration during landings and takeoffs. This technique of obtaining large samples of routine aircraft characteristics and performance data--some-

thing not heretofore available in a practical manner--should be encouraged to obtain similar information on other aircraft types.

Airborne Instruments Lab., Deer Park, N. Y.
RUNWAY CHARACTERISTICS AND PERFORMANCE OF JET TRANSPORTS IN ROUTINE OPERATION, VOLUME II. APPENDIX E. TABULATION OF BASIC DATA. Rept. on Task 15, Contract FAA/BRD-16. Mar 60, 281p. Rept. no. 5791-15.
Order from OTS $4.00 PB 161 856-2

See also PB 161 856-1

Airborne Instruments Lab., Deer Park, N. Y.
RUNWAY CHARACTERISTICS AND PERFORMANCE OF SELECTED PROPELLER-DRIVEN AIRCRAFT IN ROUTINE OPERATION. Rept. on Task 15, Contract FAA/BRD-16. Apr 60, 185p. 2 refs.
Order from OTS $3.00 PB 161 857

The average times for an aircraft to decelerate to 60 miles per hour from crossing the runway threshold are 28, 25, 31, and 14 seconds, respectively, for the four categories studied. The ground speeds, 900 feet past the runway threshold, are 114, 109, 98, and 61 knots. The rate of deceleration increases to a maximum at a velocity between 75 to 85 knots for four-engine aircraft and 50 knots for the twin engine aircraft. (Author)

Armour Research Foundation, Chicago, Ill.
DETERMINATION OF EMISSIVITY AND REFLECTIVITY DATA ON AIRCRAFT STRUCTURAL MATERIALS. PART III. TECHNIQUES FOR MEASUREMENT, by O. Harry Olson and James C. Morris. Rept. for 1 May 57-1 May 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3002. Apr 60, 104p. 5 refs. WADC Technical rept. 56-222, Pt. III.
Order from OTS $2.50 PB 161 839

Total normal emissivity is the ratio of total normal radiance emitted by a material to that emitted by an ideal blackbody at the same temperature. Parts I and II describe equipment and techniques employed for obtaining total normal emissivities of conducting materials, such as metals, at elevated temperatures. Part III describes equipment and techniques developed to make similar measurements on non-conducting materials such as refractories and glasses. Several samples are heated simultaneously in a tubular, wire wound furnace and presented successively in the field of view of a thermistor detector through a port in the furnace wall. The equipment and methods are described and data are presented for a list of materials. Low temperature measurements were made with equipment described in Part I and II. An integrating sphere reflectometer was used to measure spectral reflectivity and transmission in the spectral range, 0.3 to 3.0 microns. This employs a Perkin-Elmer monochromator, a comparison integrating sphere, and a lead sulfide detector. (Author) (See also PB 151 603)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
A DISCUSSION OF RESTRAINT AND PROTECTION OF THE HUMAN EXPERIENCING THE SMOOTH AND OSCILLATING ACCELERATIONS OF PROPOSED SPACE VEHICLES, by Carl C. Clark and R. Flanagan Gray. Rept. on Proj. TED ADC AE-1412. 29 Dec 59, 56p. 8 refs. Rept. no. 5 on Task MR 005.12-0005.6; NADC MA-5914; AD-234 597.
Order from LC mi$3.60, ph$9.30 PB 146 961

It is not the forces generated by acceleration or deceleration (at least to somewhat beyond 30 G) which damage man, but rather the body distortions which can result from an unbalanced action of these forces. By proper packaging of the human, tolerance will depend on the consequences of local tissue compression or extension rather than on the consequences of gross tissue and organ displacements and distortions. Techniques of centrifuge simulation are presented. A moulded body form contour couch provides a broadened support and reduces body distortion. Tight bandaging of the body and training in techniques of complete body straining are important aspects of these experiments. Water immersion can further reduce body distortions while under acceleration. particularly if in addition the lungs are pressurized. Work on the consequences of long duration acceleration is underway; a man has tolerated 2 G for 24 hr.

Columbia U., New York.
ON STRESS INTERACTION IN FATIGUE AND A CUMULATIVE DAMAGE RULE. PART II. 7075 ALUMINUM ALLOY, by Alfred M. Freudenthal and Robert A. Heller. Rept. for 1 Feb-31 Dec 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3982. Jan 60, 23p. 4 refs. WADC Technical rept. 58-69. Pt. II; AD-234 448.
Order from OTS $0.75 PB 161 837

The object of this investigation was the determination of the effects of stress interaction, under randomized stress distributions representing gust and maneuver loads on aircraft wings, on the fatigue life of 7075 aluminum alloy specimens. On the basis of numerous rotating bending fatigue tests it has been demonstrated that the linear cumulative damage rule does not provide a safe fatigue life estimate of unnotched specimens. A non-linear rule representing the test results fairly well has been proposed. (Author) (See also PB 140 816)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
SPECIFICATION FOR A PROXIMITY WARNING INDICATOR: PILOT RESPONSE EVALUATION TEST, by C. Wightman. Rept. on Contract AMB-15. Aug 58, 31p. 11 refs. Rept. no. JA-1266-S-5.
Order from OTS $1.00 PB 161 855

By fixing a number of possible input variables near their optimum values, it has been possible to design an experiment which will provide the desired information at much lower cost and complexity than would be required for a full treatment of all variables. The result will be an evaluation of proximity warning indicator utility under good conditions. The path to follow in future developments of such devices as well as the utility of present models should be indicated by the experimental results. (Author)

Corporation for Economic and Industrial Research, Washington, D. C.
SIMULATION OF THE NAVY AIRCRAFT OVERHAUL OPERATION, by Kenneth W. Webb. Technical rept. on Contract Nonr-2755(00). 4 May 59, 24p. Rept. no. 169-2R.
Order from LC mi$2.70, ph$4.80 PB 146 535

This report describes the formulation and use of a mathematical model for simulating the Navy airframe and engine overhaul for a calender quarter.

David Taylor Model Basin, Washington, D. C.
PRELIMINARY INVESTIGATION OF PLAN FORM EFFECT ON AUGMENTATION PARAMETER FOR PERIPHERAL-JET GROUND-EFFECT MACHINES, by Anibal Alfredo Tinajero. Feb 60, 44p. 3 refs. Aero rept. 972. AD-237 673.
Order from LC mi$3.30, ph$7.80 PB 147 727

Results of static tests of four peripheral-jet ground-effect machine plan forms, with jet angle of divergence of -45° and with various tangential deflection angles. Test divided into two parts: hovering tests (zero propulsive thrust) and propulsive thrust tests. For hovering condition most desirable plan form is circular; for configurations with propulsive thrust other than zero the % drop in augmentation decreases as plan form length-to-width ratio increases. (Author)

Daystrom Systems, La Jolla, Calif.
HIGH SPEED COMMUNICATIONS EQUIPMENT, by Bill L. Waddell, Ronald H. Jones, and Gregory Johnson. Final rept. on Contract FAA/BRD-118, formerly Contract C-13ca-693. 226p. 280 refs. Rept. no. 6005-6.
Order from OTS $3.50 PB 161 858

The scope of this report is limited to those systems which use primarily wire or cable for data transmission. All lines are considered to be one-half duplex or more. The data rates handled by the lines, terminals, and terminal equipment are in excess of 600 WPM, or 455 bits/second. The minimum message length is considered as 120 characters of seven bits per character. Point-to-point or multipoint networks are considered. The report describes the requirements of the FAA for the system, a theoretical background for understanding the new field of High Speed Data Communication, the equipment available now and in the future for such a system, and evaluations of the relative capabilities of the equipment to perform to the system requirements and theoretical parameters. Techniques of utilizing the equipment in a system are described and evaluated. Recommendations are presented for further investigation which would allow the data presented here to be utilized for specific applications.

Forest Products Lab., Madison, Wis.
SUMMARY OF RESEARCH BY FOREST PRODUCTS LABORATORY ON COMPOSITE CONSTRUCTION FOR FLIGHT VEHICLES, by Donald G. Coleman. Rept. for July 57-July 58 on Rubber, Plastics and Composite Materials, Contract AF 33(616)58-1. Feb 60, 9p. WADC Technical rept. 52-184, Sup. 6.
Order from LC mi$1.80, ph$1.80 PB 149 183

Developments in the program of research in composite construction for flight vehicles conducted by the U.S. Forest Products Laboratory during 1958 are summarized. In general the approach has been to derive design criteria mathematically, and then to check by test. Four technical reports issued during the fiscal year are abstracted. (Author)

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
THE APPLICABILITY OF SIMULATION TO THE INVESTIGATION OF AIR TRAFFIC CONTROL PROBLEMS, by S. M. Berkowitz, W. W. Felton and others. Final rept. for 8 Aug 49-10 Feb 50 on Contract Cca-27722. 17 Mar 50, 118p. 7 refs. Rept. no. F-2130-1.
Order from LC mi$6.00, ph$18.30 PB 147 957

This report presents methods and devices for simulating the flight of aircraft in the general area and in the final approach areas of an airport under various conditions of wind and under various traffic control systems. Tow devices are highly recommended as capable of being pressed into immediate service for solving the problems currently demanding attention. In the final approach area each of these simulators can represent various numbers and speeds of aircraft, aircraft separation times, glide path lengths locations of exit strips, control procedures, and wind effects. In the general approach area, the transparency simulator can study and evaluate the relative merits of different methods of air traffic control. Both simulators allow study of delays, flow rates, acceptance rates, dead runway time, distance separations at any time, time separations at any point and such other time-space concepts as may be useful in establishing measures of effectiveness of various control procedures and geographic configurations.

Motorola, Inc., Scottsdale, Ariz.
HYPERBOLIC COORDINATE CONVERTER, by E. H. Lange. Final engineering rept. 15 Sep 59-15 Jan 60, on Contract FAA/BRD-130. 15 Jan 60, 154p.
Order from OTS $3.00 PB 161 853

A study has been conducted to establish the optimum design for a practical, airborne computer that would accept the hyperbolic information available from present low-frequency navigational aids and convert it to a form better suited for air traffic control and general navigation. The outputs chosen for display are distance-to-go and cross-track distance, since these coordinates correspond to displacement from, and distance along, a pre-assigned corridor. The design philosophy employed resolves the conflicting requirements of computer simplicity, long-range operation, and high accuracy report of present-position. The associated computation time is shown to be compatible with the dynamic constraints imposed by atmospheric noise and aircraft velocity considerations. The recommended coordinate converter can be readily combined with other navigational aids to form a complete and integrated control system. Full derivations of the appropriate mathematical results are included along with substantial documentation of the major conclusions reached.

National Research Labs., Ottawa (Canada).
GENERALIZED TABLES FOR THE CALCULATION OF TRAJECTORY CURVES FOR BODIES MOVING IN AIR, by M. M. Currie. 1 Apr 60, 57p. 1 ref. Aeronautical rept. LR-277.
Order from LC mi$3.60, ph$9.30 PB 148 427

Tables are presented from which the cartesian coordinates of a trajectory can be readily derived for any initial conditions if the terminal velocity of the body is known. (Author)

Naval Ordnance Test Station, China Lake, Calif.
ALIGNMENT OF MOVING INERTIAL NAVIGATION SYSTEMS, by Richard B. Seeley and Roy Dale Cole. 17 Dec 59, 48p. 6 refs. NOTS TP-2279; NAVORD rept. 6561; AD-234 263.
Order from LC mi$3.30, ph$7.80 PB 146 340

This report describes and discusses some of the techniques by which a moving inertial platform may be aligned by using external velocity measurements, and also presents some of the major problems and error sources affecting such alignment. (Author)

[Pacific] Missile [Range] Port Mugu, Calif.
CAPTIVE FLIGHT TESTS OF THE KD2C-2 POWER PLANT TEST PACKAGE, by H. M. Keuhaus. Rept. on Proj. TED MTC PP-301. 10 Sep 50, declassified 12 June 56, 49p. Technical rept. no. 78.
Order from LC mi$3.30, ph$7.80 PB 148 639

Captive flight tests of the KD2C-2 power-plant package, a pulsejet-type air-engine assembly, were conducted on an A-26 parent airplane at various airspeed and altitude conditions for the purpose of determining the performance and cooling characteristics of the installation. The flight-test program disclosed that the KD2C-2 power-plant installation in its final configuration could be operated satisfactorily throughout the range of flight conditions investigated.

[Pacific] Missile [Range] Port Mugu, Calif.
DEVELOPMENT AND EVALUATION TESTING OF KDH-1 TARGET P/A, by George M. Miller. 1 Apr 49, declassified 12 June 56, 32p. 7 refs. Proj. TED MTC PA-(602, 603); Technical rept. no. 45.
Order from LC mi$3.00, ph$6.30 PB 148 627

This report treats of the results and conclusions derived from 87 flight tests of the KDH-1 target P/A conducted at NAMTC. These tests revealed many difficulties in launching, propulsion, and control that were not apparent in tests of previous low-performance target P/A. After a study of these problems, remedies were devised and tested, with resultant improvements. The test results discussed in this report provided valuable information for the construction and operation of other target P/A of this type, but did not develop the KDH-1 target P/A to a state where it could be used satisfactorily for Fleet operation. (Author)

[Pacific] Missile [Range] Port Mugu, Calif.
EVALUATION OF ELECTRONIC COMPONENTS IN CTV-N-4 AND CTV-N-6 (GORGON) AIRFRAMES, by L. E. Day. Rept. on Proj. TED MTC EL-303. 20 Oct 49, declassified 12 June 56, 77p. 5 refs. Technical rept. no. 61.
Order from LC mi$4.50, ph$12.30 PB 148 632

This report describes the work accomplished in preparing for the flight tests. It includes the development of an instrumentation recovery system and modification of JB-2 pneumatic servos for use in GORGON airframes. The results achieved are of value because of their applicability to other missile test projects.

P[acific] Missile [Range] Port Mugu, Calif.
EVALUATION OF THE KD2G-1 TARGET P/A, by Homer W. Parker. Rept. on Proj. TED MTC PA-614. 28 Oct 49, declassified 12 June 56, 80p. 4 refs. Technical rept. no. 62.
Order from LC mi$4.50, ph$12.30 PB 148 633

The evaluation program was organized to study each flight in three parts. The first part consisted of the preflight preparations required to prepare the P/A for flight. The second part covered the P/A from the time of launching until the P/A was recovered by the retrieving crew. The third part covered the postflight analysis of damage, repair requirements, servicing difficulties and routine maintenance.

[Pacific] Missile [Range] Port Mugu, Calif.
EVALUATION OF THE KD2R-3 TARGET P/A, by D. E. Humbert and J. H. Hooper. Rept. on TED MTC GM-618. 20 May 52, declassified 12 June 56, 51p. 2 refs. Technical rept. no. 88.
Order from LC mi$3.60, ph$9.30 PB 148 640

The KD2R-3 meets the majority of the performance requirements, but that certain changes must be made for its improvement. The P/A was found to be acceptable from a maintenance and serviceability standpoint provided minor changes are made.

[Pacific] Missile [Range] Port Mugu, Calif.
FLIGHT AND GROUND TESTS OF THE KDH-1 TARGET P/A, by George M. Miller. Rept. on TED MTC PA-612. 19 Apr 50, declassified 12 June 56, 36p. Technical rept. no. 72.
Order from LC mi$3.00, ph$6.00 PB 148 637

[Pacific] Missile [Range] Port Mugu, Calif.
FLIGHT TESTING OF THE KDG-2 TARGET P/A, by J. B. Stevens and Norman Rohn. Rept. on Proj. TED MTC PA-610. 12 Apr 50, declassified 12 June 56, 68p. 13 refs. Technical rept. no. 71.
Order from LC mi$3.90, ph$10.80 PB 148 636

In the flight test phase of the project, air speed, rate of climb, receiver range, maneuverability and controllability, endurance, and launching characteristics

were examined. The changes considered most essential as a result of these tests include: elimination of the propeller spinner, strengthening the tank section to withstand parachute landings, modification of the servomotors, adoption of the 32-foot standard parachute, and improvement of the flotation characteristics. Certain other changes discussed in this report are considered desirable but not necessary.

[Pacific] Missile [Range] Port Mugu, Calif.
THE GENERAL PERFORMANCE AND SPECIFICATION CONFORMITY OF THE KD2R-2 TARGET P/A, by George M. Miller. Final rept. on Proj. TED MTC PA-609. 1 Sep 59, declassified 12 June 56, 43p. 5 refs. Technical rept. no. 59.
Order from LC mi$3.30, ph$7.80 PB 148 630

The tests described herein were conducted for determination of the general performance of the KD2R-2 and its conformance with specifications. The results obtained from these tests indicate that the KD2R-2 conforms generally to the Detail Specifications, but does not have adequate flotation or watertight integrity characteristics. With the recommended modifications incorporated, the P/A should be suitable for Fleet use. It is considered to have very satisfactory stability and structural integrity characteristics. (Author)

[Pacific] Missile [Range] Port Mugu, Calif.
TEST AND EVALUATION OF THE KD3G-2 (SNIPE) TARGET P/A, by W. C. Slowey. Final rept. on Proj. TED MTC PA-604.2. 19 June 50, declassified 12 June 56, 76p. 8 refs. Technical rept. no. 74.
Order from LC mi$4.50, ph$12.30 PB 148 638

In the over-all performance phase of the project, air speed, maneuverability and controllability, endurance, launching characteristics, parachute recovery, and flotation times were examined. Component performance evaluation was based on behavior during flight and upon laboratory-type ground tests of those components to which failures were attributed or in which failures were anticipated. As a result of these tests, the changes to the target P/A recommended as most essential include: attachment to the fuselage of a protective longitudinal keel, use of a stronger and more easily repairable tank section, modification of the servomotors, shielding of ignition leads, improvement in design and construction of engine cowl, strengthening of parachute suspension cables, and improvement of flotation characteristics.

[Pacific] Missile [Range] Port Mugu, Calif.
TEST AND EVALUATION OF THE XKD2R-1 TARGET P A, by George M. Miller. 27 Sep 48, declassified 12 Jun 56, 46p. 6 refs. Proj. TED MTC PA-607; Technical rept. no. 32.
Order from LC mi$3.30, ph$7.80 PB 148 625

This report discusses the numerous static and flight tests of the XKD2R-1 target P/A, and its evolution to a remotely-controlled target pilotless aircraft suitable for Fleet use. A total of 89 flight tests were made during the test and evaluation program. Many modifications were made to the aircraft with the result that the XKD2R-1 became a reliable and efficient target P/A suitable for production and service use. The modified XKD2R-1 proved to be superior to all previous service target P/A. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
A NEW THEORY OF SANDWICH PLATES. GENERAL CASE, by Yi-Yuan Yu. Technical note no. 6 on Contract AF 49(638)453. Nov 59, 28p. 8 refs. AFOSR-TN-59-1163; AD-234 222.
Order from LC mi$2.70, ph$4.80 PB 146 741

The general 2-dimensional case is given of a new theory of elastic sandwich plates. Extension as well as flexure is considered, and the core of the sandwich may be either isotropic or orthotropic. The general theory is valid for any symmetrically arranged 3-layered plate and for vibration analysis involving wide frequency ranges. For sandwiches with very thin faces simplified equations good for limited frequency ranges are deduced. A brief discussion is given on sandwiches with cores composed of Kelvin-Voigt material. (Author)

Princeton U., N. J.
MANEUVERING CAPABILITY OF AN ANNULAR JET GROUND EFFECT MACHINE, by W. B. Nixon. Rept. on Contract DA 44-177-TC-524. May 60, 71p. 9 refs. Dept. of Aeronautical Engineering rept. no. 515.
Order from LC mi$4.50, ph$12.30 PB 148 776

An elementary analysis, employing non-mixing theory, is made of three general methods of control. The possible advantages of redistributing the annular jet strength are investigated. The slanted jet "integrated" system is the most effective within certain restrictions. Separate thrusting and tilting are seen to have some attributes, particularly in practical application. Side force fins are suggested. The pitching moments introduced with the application of control forces are discussed. Yaw control is found to be more effective with the slanted jet. A comparison with other surface vehicles accentuates the maneuvering limitations of a GEM. Operation over land may require much higher hovering capability than is generally conceded on the basis of performance. (Author)

Princeton U., N. J.
SOME QUALITATIVE CHARACTERISTICS OF A TWO-DIMENSIONAL PERIPHERAL JET, by W. B. Nixon and T. E. Sweeney. Rept. on Contract DA 44-177-tc-524. Sep 59, 19p. Aeronautical Engineering rept. no. 484; AD-233 215.
Order from LC mi$2.40, ph$3.30 PB 146 607

Base pressure distributions of a 2-dimensional peripheral jet model in simulated hovering flight is discussed. Flow patterns were deduced from these distributions and were verified with smoke studies. The standing vortex associated with this type of device is plotted as a function of altitude and angle of inclination, and the relationship between the vortex and static instability is shown for 3 initial jet angles. Also included is a brief discussion of the unsteady flow pattern generated at certain altitudes and initial jet angles. This flow is plotted and is shown to deteriorate, apparently, into a Karman street - possibly explaining the critical altitude reported by other investigators. (Author)

Southern Research Inst., Birmingham, Ala.
DETERMINATION OF THE MECHANICAL PROPERTIES OF AIRCRAFT-STRUCTURAL MATERIALS AT VERY HIGH TEMPERATURES AFTER RAPID HEATING, by James B. Preston and J. Robert Kattus. Rept. for May 57-June 59 on Development and Evaluation of Materials for ICBM and IRBM Applications, Contract AF 33(616)3494. Apr 60, 81p. 18 refs. WADC Technical rept. 57-649, Pt. II.
Order from OTS $2.25 PB 161 893

The short-time, elevated-temperature tensile properties were determined and are reported (1) for unalloyed beryllium at temperatures from ambient through 1500°F (2) for ten combinations of base materials (ETP copper, A-nickel, unalloyed molybdenum, and molded graphite) with protective coatings (chromium and nickel by electroplating; aluminum oxide, zirconium oxide, and zirconium silicate by flame spraying; silicon carbide and silicon carbide-nitride by a diffusion reaction on the surface of graphite), and (3) for a typical high-temperature alloy with linear temperature gradients normal to the axis of loading. (Author) (See also PB 131 664)

Stanford U., Calif.
HIGH TEMPERATURE STRUCTURES, by N. J. Hoff. Rept. on Contract AF 49(638)223. June 58, 46p. 30 refs. SUDAER no. 79; AFOSR-TN-60-383.
Order from LC mi$3.30, ph$7.80 PB 148 750

A survey is given of the new problems confronting the airplane and missile structural designer and analyst in consequence of aerodynamic heating. The need to expand the knowledge of the structures man into such fields as gas dynamics, thermodynamics and the physics of the solid state is pointed out. (Author)

United Research, Inc., Cambridge, Mass.
A METHOD FOR DETERMINING THE ECONOMIC VALUE OF AIR TRAFFIC CONTROL IMPROVEMENTS AND APPLICATION TO ALL-WEATHER LANDING SYSTEMS. VOLUME I. Rept. on Contract FAA/BRD-17. [1960] 28p.
Order from OTS $0.75 PB 161 852

The method developed for the determination of economic benefits associated with Air Traffic Control improvements is based on the measure of the effects of these improvements (1) in dollar terms on the demand for and the cost of airline passenger transportation, (2) on the costs of general aviation transport, including value of passenger time, and (3) on the annual value of the accidents (loss of property and life) prevented. To determine the annual net return from any selected improvement, the dollar values determined for each of the above measures are summed and the annual operating costs of the improvement are then subtracted. A present value formula which takes into consideration the applicable interest rate and the number of years the improvement can be expected to be in operation is then applied to determine the investment in an improvement which can be justified. In applying the method to a selected improvement the two necessary preliminary steps are determination of the physical effect of the improvement and calculation of the annual reduction in the physical units of disruption, delay, cancellation and diversion. Economic benefits associated with an improvement can then be computed. The method is applied to the effects of an all-weather landing system.

Vehicle Research Corp., Pasadena, Calif.
LIFT CHARACTERISTICS OF WINGS EXTENDED THROUGH PROPELLER SLIPSTREAMS, by Scott Rethorst, Winston Royce and T. Yao-tsu Wu. Rept. no. 1 on Contract Nonr-2388(00). Sep 58, 178p. 16 refs.
Order from LC mi$8.10, ph$27.30 PB 146 592

The study has shown that the lift generating capabilities of wings extending through a jet varies greatly with the wing plan form. The study has shown the existence of and located the finite optimum plan forms for such wings for an extensive range of wing areas and jet velocity ratios. The results obtained have been shown in the limit to approach well known uniform flow results. The results suggest that programmed sectional wing twist, provided for example by flaps, would permit the attainment of an exceptionally high stalling lift coefficient with a gradual stall pattern progressing inboard to the root.

Vehicle Research Corp., Pasadena, Calif.
LIFTING SYSTEMS FOR VTOL VEHICLES, by Scott Rethorst and W. W. Royce. Rept. no. 2 on Contract Nonr-2388(00). 2 May 59, 76p. 4 refs.
Order from LC mi$4.50, ph$12.30 PB 146 523

The various lift generating systems currently of interest for VTOL vehicles are analyzed and compared. Among the lift systems discussed are fixed wing, actuator disc, both ducted and unducted, annular jet, and pressure leakage devices. The force generation of each of these devices is derived from fundamentals. A simple theory for the annular jet is formulated and developed far enough to demonstrate its primary features so as to permit comparison with the other arrangements. Efficiency and force effectiveness, at both zero and forward velocities, are then calculated to provide a uniform basis for the comparative evaluation of these several lifting systems.

Chemical Engineering

Brigham Young U. [Provo, Utah].
HIGH TEMPERATURE STUDIES, by H. Tracy Hall. Final rept. for 19 June 56-31 Mar 60 on Contract DA 04-495-ORD-792. [1960] 41p. 6 refs. OOR rept. 1692.2-Met.
Order from LC mi$3.30, ph$7.80 PB 148 443

An apparatus for subjecting up to 10 cubic centimeters of material to pressures of 15,000 atmospheres at temperatures as high as 10,000°C has been developed and described. The apparatus is relatively simple in its design and could readily be scaled-up by a factor of 25 in volume, if desired. Temperatures of 10,000°C can usually be maintained for periods of 5 to 15 seconds, but in some instances have been maintained for as long as one minute. With this new apparatus, a survey of the effects of very high temperature

has been made on several carbide, boride, nitride, phosphide, oxide, sulfide, and some miscellaneous systems. One material produced under these high-temperature, moderate pressure conditions may have immediate practical use. This material is fused silicon carbide. The compressive strength of this material is 30 times as great as that of ordinary hot-pressed SiC. This high strength silicon carbide may be useful as a cutting tool material. Some of the oxide systems of chromium and manganese exhibited rather high compressive strengths following high temperature treatment. This was true also for ZrB_2 and TiB_2. Some of the metallic oxides produced under high temperature conditions formed semi-conducting materials and might be of further interest with respect to their electrical properties.

Office of Technical Services, Dept. of Commerce, Washington, D. C.
DESALINATION OF WATER. [July 60] 4p. 78 refs. OTS Selective Bibliography SB-419.
Order from OTS $0.10 OTS SB-419

A bibliography of reports listed in the two OTS monthly abstract journals: U.S. Government Research Reports and Technical Translations.

Solar Aircraft Co., San Diego, Calif.
PORTABLE GAS TURBINE FOR GENERATOR DESIGN STUDY, by Leland F. Blinman. Final rept. on Contract DA 18-108-405-cml-195. 13 Mar 59, 63p. Solar ER-815; AD-212 298.
Order from LC mi$3.90, ph$10.80 PB 148 446

Gas turbine attributes for use as portable fog generators include: low weight, reliable starting and operation, controlled gas stream temperature, large volume and high velocity exhaust gas stream, low maintenance. The object of this study was the delineation of a fog generator design, based upon the gas turbine cycle, that provides the following characteristics: exhaust gas output of 2 lb/sec at 1000 deg F, variable from 800 to 1000 deg F.; fog oil rate of 150 gal/hr.; started by hand cranking (or high pressure air impingement); total weight of 102 lb, an envelope of 23 in. x 23 in. x 28. in. high; overhaul interval 50 to 200 hours.

Southern Research Inst., Birmingham, Ala.
DEVELOPMENT, CONSTRUCTION, AND TESTING OF OSMIONIC DEMINERALIZERS, by R. E. Lacey, E. W. Lang, and C. E. Feazel. Rept. on Contract no. 14-01-001-88. June 60, 95p. 7 refs. Saline Water Research and Development Progress rept. no. 38.
Order from OTS $2.25 PB 161 862

An operable over-all design for osmjonic demineralization has been demonstrated on a small scale, although the size, shape, or materials of particular components may still be changed to obtain better or lower-cost operation. The estimated costs of demineralization, based on the above design, appear to be competitive with those of other processes. However, certain problems that may alter the cost picture remain to be studied in more detail.

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
DUSTPROOFING AND WATERPROOFING OF SOILS. FIELD AND LABORATORY INVESTIGATIONS OF SELECTED MATERIALS, by G. R. Kozan and J. D. Stouffer. Dec 59, 90p. 7 refs. Technical rept. no. 3-530, rept. 1; AD-231 925L.
Order from LC mi$4.80, ph$13.80 PB 146 565

Based on an extensive review of soil-treatment agents, 13 materials were selected for evaluation of their dustproofing and waterproofing capabilities. Of the materials investigated, aniline-furfural, MC-O asphalt, sodium methyl-ethyl propyl siliconate, the quaternary ammonium chloride, the commercial road oil, and the chemically modified MC-O asphalt were sufficiently effective both as dustproofers and waterproofers to warrant further investigation.

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
PREFABRICATED AIRFIELD AND ROAD SURFACING MEMBRANES: TORRID ZONE STORAGEABILITY TESTS, 1954-1957, by S. G. Tucker. May 60, 32p. 2 refs. Technical rept. no. 3-515, rept. 2.
Order from OTS $1.00 PB 161 869

Laboratory and field tests were conducted on coated cotton duck, cotton knit, and cotton tire-cord fabrics to determine their suitability for three years storage in the Torrid Zone. The performance under exposure of dry-back adhesive, which is used to fasten strips of membrane together, was also observed. In the laboratory, the tensile strength of each membrane was determined before, during, and after the storage period; the effects of weathering were also determined by measuring thicknesses and weighing samples of the membranes before and after the three-year storage period. In the field, membrane rolls on wooden and cardboard cores were placed in a rack and exposed to prevailing weather conditions with no protection from rain or sun. The membranes were inspected periodically, and photographs taken to record important developments. Temperature, rainfall, and relative humidity data were recorded throughout the storage period. (Author)

Bureau of Yards and Docks, Washington, D. C.
INSPECTION FOR MAINTENANCE OF PUBLIC WORKS AND PUBLIC UTILITIES, VOLUME 1. 22 Dec 59, 283p. Technical pub. NAVDOCKS P-322; BUDOCKSINST 11014.13B.
Order from LC mi$11.10, ph$44.10 PB 147 655

Efficient and economical management requires that undermaintenance and overmaintenance be avoided, that corrective action be taken on deficiencies before deterioration necessitates major repairs, and that the various items of public works and public utilities meet their functional requirements. This publication has been prepared to gather together the numerous and interrelated responsibilities pertaining to maintenance inspection of public works, public utilities, and civil works facilities. Application of inspection, as outlined herein, will assist in protecting the Government's very large property investment.

Bureau of Yards and Docks, Washington, D. C.
INSPECTION FOR MAINTENANCE OF PUBLIC WORKS AND PUBLIC UTILITIES. VOLUME 2. INSPECTION GUIDES-ELECTRICAL. 2 June 58, 64p. 16 refs. Technical pub. NAVDOCKS TP-Pw-31; BUDOCKSINST 11014.13A.
Order from LC mi$3.90, ph$10.80 PB 147 652

See also PB 147 655

Bureau of Yards and Docks, Washington, D. C.
INSPECTION FOR MAINTENANCE OF PUBLIC WORKS AND PUBLIC UTILITIES. VOLUME 3. INSPECTION GUIDES-MECHANICAL. June 58, 78p. 22 refs. Technical pub. NAVDOCKS TP-Pw-31; BUDOCKSINST 11014.13A.
Order from LC mi$4.50, ph$12.30 PB 147 653

See also PB 147 652

Bureau of Yards and Docks, Washington, D. C.
INSPECTION FOR MAINTENANCE OF PUBLIC WORKS AND PUBLIC UTILITIES. VOLUME 4. INSPECTION GUIDES-STRUCTURAL. June 58, 48p. 16 refs. Technical Pub. NAVDOCKS TP-Pw-31; BUDOCKSINST 11014.13A.
Order from LC mi$3.30, ph$7.80 PB 147 654

See also PB 147 653

Columbia U., New York.
ON THE INDEPENDENCE OF YEARLY WATER INPUTS IN DAMS, by J. Gani and B. R. Bhat, (U. of California). Rept. on Contract Nonr-266(59). [1959] 17p. 11 refs. CU-8-59-Nonr-266(59)MS.
Order from LC mi$2.40, ph$3.30 PB 148 573

The paper considers an assumption in Moran's theory of dams [Australian J. Appl. Sci. 5:116-124, 1954], this is that the yearly water inputs into a reservoir are independently distributed. To test the hypothesis, two models are constructed for the annual discharges of 17 Australian rivers. The first, a Markov process with normal residuals, leads to the tentative conclusion that discharges from most of the rivers (some only after transformation) are serially independent. From the second model, a simple Markov chain, it is shown that no reliable conclusion can be drawn. Moran's assumption is accepted as a useful first approximation for all but two of these rivers. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
DESIGN CHARTS FOR R/C BEAMS SUBJECTED TO BLAST LOADS, by J. R. Allgood and G. R. Swihart. Final rept. 11 May 60, 141p. 16 refs. Technical rept. 069. AD-237 958.
Order from LC mi$7.20, ph$22.80 PB 148 241

An ultimate load theory is combined with an idealized dynamic theory to form a computational program for the development of a set of design charts for reinforced concrete beams. The behavior of beams under blast loading is reviewed to aid in the explanation of the computational program and the charts. A procedure for the treatment of shear and bond is presented; the design curves are given and exemplified; and their limitations are discussed.

Admiral Corp., Chicago, Ill.
EVALUATION-DEVELOPMENT OF MIL-C-14157 CAPACITORS FOR NUCLEAR RADIATION ENVIRONMENT, by E. R. Pfaff. Scientific rept. no. 3 on Contract NObsr-77612. May 60, 77p.
Order from LC mi$4.50, ph$12.30 PB 148 237

In environmental tests forty-nine of the fifty irradiated samples failed within 154 hours. Of the fifty control samples, eighteen are remaining on test after 400 hours. The irradiated group with the pulsed voltage applied failed rapidly after 65 hours indicating a possible structural change in the units. After 300 hours of irradiation Mylar and Kraft paper were extremely brittle and the units had high internal gas pressure. Preliminary studies of FS-5 and FC-43 dielectric fluid indicate they evolve Fluorine gas during irradiation. Capacitors impregnated with C_{16-18} alkyl bi-phenyl dielectric fluid and solid impregnants are being investigated. (Author)

Aeronautical Electronic and Electrical Lab., Naval Air Development Center, Johnsville, Pa.
SIMULTANEOUS HEAT AND MASS TRANSFER AND ITS APPLICATION TO AIRBORNE ELECTRONIC COOLING, by A. Saltzman. Technical note. 4 May 56, 29p. 3 refs. Rept. no. NADC-EL-N5626.
Order from LC mi$2.70, ph$4.80 PB 148 422

Emphasis is placed on the role of momentum and mass transfer as the "cause" of the cooling problem, and on the limitations of using air alone as a coolant. The main facets of the cooling problem include important design features of the electronic cooling tower system such as means of relegating air to carrier of vapor heat, enthalpy concept, techniques of diffusing vapor heat through stagnant air, high heat capacity characteristics of a two component (vapor-air) system, the high latent heat of vaporization at low dry bulb temperatures, application of fin technology to evaporative cooling, and the application of conventional techniques of calculations of number and height of transfer units.

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
BIBLIOGRAPHY ON THERMOELECTRICITY, by S. Goldman. Rept. on Contract NOrd-7386. Nov 58, 25p. 130 refs. TG-326.
Order from LC mi$2.70, ph$4.80 PB 149 555

The bibliography lists the literature cited in Physics Abstracts, Electrical Engineering Abstracts, and Chemical Abstracts from January 1939 through mid 1958. While only a handful of the papers listed deal with engineering applications of thermoelectricity, this should not be taken as a measure of the relative engineering importance of these effects. Rather this is simply an indication of the severe proprietary restrictions on the publication of the results of the applied work.

Armour Research Foundation, Chicago, Ill.
CONTINUOUS FEED BATTERY, by H. F. Bauman and Howard T. Francis. Final rept. 15 Apr 56-15 July 57, on Contract NObs-72131. 30 Sep 57, 15p. AD-158 048.
Order from LC mi$2.40, ph$3.30 PB 148 385

The proposed system was based on a magnesium or aluminum anode with hydrogen peroxide as the cathode reactant. The magnesium-hydrogen system was investigated including determinations of anode evolutions of hydrogen and conditions for platinum black formation resulting in highest cell potential. The maximum load potential of the magnesium-hydrogen peroxide cell was 1.00 v at a cathode current density of 10 amp/sq ft, and changes in cell composition caused little change in potential. Magnesium anodes were used at current densities to 75 amp/sq ft with little polarization in 3.5% NaCl solution. Evolution of hydrogen from such an anode decreased as current density was increased and was approximately half that of the cathode gas in a magnesium-hydrogen cell. Conditions of platinum black formation were reflected in large changes in the cathode reaction potential. Magnesium-hydrogen cells were discharged for long periods by replacing the anode as consumed, but with no electrolyte changes. (Author)

Armour Research Foundation, Chicago, Ill.
PROCEEDINGS OF THE CONFERENCE [NO. 1] ON RADIO INTERFERENCE REDUCTION HELD AT THE ARMOUR RESEARCH FOUNDATION, OF ILLINOIS INSTITUTE OF TECHNOLOGY, DECEMBER 7-8, 1954. Dec 54, 356p. 63 refs.
Order from LC mi$11.10, ph$54.60 PB 148 071

Vehicular radio noise suppression, control of radio influence voltage in DC rotating electrical machines, shipboard electronic and electrical installation methods for reduction of electronic interference, problems of radio interference measurements, instrumentation for interference and field strength measurement, research investigations of interference measuring instruments, problems in shielding electronic equipment, reduction of corona type interference, audio frequency interference considerations in aircraft electronic system design, interference considerations in aircraft antenna systems, a method of making screen room interference measurements, broadband absorbent material for use in microwave darkrooms, counter techniques in interference measurements, impulse spectrum analysis for calibration of impulse noise generators, interference considerations in design of communications receivers, contract noise and problems of its suppression, radar modulator suppression, receiver susceptibility to RF pulse interference, harmonic and spurious energy measurements in high power transmitters, bridged-T technique for the measurement of spurious radiation, techniques for the measurement of spurious radiation and harmonics from transmitters, low-impedance gaskets for radio-frequency applications, suppression capacitors, high-performance antenna wave filters for radio interference suppression, propagation and antenna considerations in the prediction of man-made interference.

Armour Research Foundation, Chicago, Ill.
PROCEEDINGS OF THE CONFERENCE [NO. 3] ON RADIO INTERFERENCE REDUCTION HELD AT THE MUSEUM OF SCIENCE AND INDUSTRY, CHICAGO, ILLINOIS, FEBRUARY 26-27, 1957. Feb 57, 503p. 81 refs. AD-234 211.
Order from LC mi$11.10, ph$77.40 PB 148 072

Contents: Calculation and measurement of radar interference signal levels; a self contained interference blanker for radar receivers; RF interference - free design techniques in radar systems; a new technique for evaluating RF leakage and susceptibility of electronic equipment; high power radar spurious frequency outputs; quicker and simpler means for interference detection and suppression; insertion loss measurements of RF suppression filters with rated current applied; some unusual aspects of MIL - I - 6181B radio interference measurements; the measurement of the susceptibility of a radio receiver to interference; design and evaluation techniques for reducing radio interference from UHF communication equipment; suppression of spurious outputs from pulsed transmitters; bidimensional interference analysis; problems in the development of an airborne interference blanker; natural interference parameters in the airborne weapon system environment; radio interference studies conducted on typical USAF aircraft and equipment; results of the UHF mutual environment test program at Rome Air Development Center; interference problems in pulse systems; precipitation static noise generation in aircraft antennas near dielectric surfaces; interference sources and effective reduction procedures for power line interference; theoretical formulas for calculating the shielding effectiveness of perforated sheets and wire mesh screens; brushless, regulated generator of radio interference-free design; design of combination fluid or pressure and RF gaskets; the control of interference through basic design; radio interference reduction in an existing equipment; electronics interference reduction aboard naval vessels; field intensity measurements on industrial, scientific and medical RF equipment; measurement of radiated and conducted energy from high-frequency stabilized electric arc welders; general interference prediction considerations; ground effects in the near field: the measurement of RF leakage from coaxial cables; prediction of power densities in the vicinity of large antennas and detection of impulse signals in random noise.

Army Engineer Research and Development Labs., Fort Belvoir, Va.
INVESTIGATION OF COLD-TEMPERATURE CHARACTERISTICS OF SONOTONE, 100-AMPERE-HOUR, NICKEL-CADMIUM BATTERIES, by James E. Griffin. 30 Nov 59, 33p. Technical rept. 1607-TR; AD-232 337.
Order from LC mi$3.00, ph$6.30 PB 146 661

This report describes the engineering tests and summarizes the results of the tests conducted at an ambient temperature of -65°F. on two 12-volt. nickel-cadmium batteries. Tests included discharge characteristics of the batteries after they were cold-soaked at -65°F, both prior to and after application of a short circuit at the battery terminals; charging characteristics of the batteries at -65°F.; and discharge characteristics of the batteries into a low impedance.

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
FIELD SPLICE AND CONNECTORS FOR COAXIAL CABLE TYPE RG-85A/U, by Morton Pomerantz. 3 Dec 57, 29p. 4 refs. Technical memo. no. M-1930; AD-156 262.
Order from LC mi$2.70, ph$4.80 PB 146 590

Series LC connector Type UG-1179( )/U has been newly designed for use with RG-85A/U cable in fixed station radio receiving installations. This one connector, used in conjunction with other standard connectors eliminates the need for the special fittings and splices which have been used in such installations in the past. The simplicity of the design of the UG-1179( )/U permits greater ease of assembly and maintenance, and alleviates to a great extent the possibility of damage in normal handling. The high cost of the standard Navy splice kit has been eliminated. These features have overcome the inherent shortcomings of the special fittings which have been used in the past. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
MICROWAVE CIRCUITRY FOR A FREQUENCY TRANSLATOR, by Robert D. Standley, Charles P. Heinzman, and Nathan Lipetz. 6 Oct 58, 22p. 10 refs. USASRDL Technical rept. 1994; AD-211 334.
Order from LC mi$2.70, ph$4.80 PB 148 112

The microwave circuitry covered by this report was developed for a frequency translator which used a highly stable ammonia beam Maser output of 23,870 mc to stabilize a 300 mc signal. This was achieved through the use of harmonic conversion and dual mixing techniques. Detailed design information of a harmonic generator, TE_{011} mode filters, and polarization convertors is included. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
PIEZOELECTRIC QUARTZ VIBRATORS: PROPERTIES OF CUTS AND MODES OF VIBRATION, by R. Bechmann. 31 Dec 58, 59p. 52 refs. USASRDL Technical rept. 2003; AD-220 106.
Order from LC mi$3.60, ph$9.30 PB 146 653

The parameters of the various modes of quartz bars and plates practically used for frequency control were calculated and are compared with experimental data. The results are given in the form of tables for the various cuts and the figures given are of practical importance as design data for the production of resonator and filter crystals. The temperature behavior of the so-called zero temperature cuts and the dimensions of the quartz vibrator are discussed. The filter crystal design is also considered. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
THE USE OF AN X-BAND SOLID-STATE RUBY MASER WITH A CONVENTIONAL DUPLEXING SYSTEM, by John L. Carter, Morris Katzman, and Irving Reingold. 15 Jan 60, 19p. USASRDL technical rept. 2095; AD-234 085.
Order from LC mi$2.40, ph$3.30 PB 148 002

A series of experiments were performed with an X-band solid-state ruby maser and several conventional types of X-band duplexer tubes under conditions which simulated actual radar system application. Leakage levels for the onset of deterioration of maser performance and for saturation of the maser were determined. Measurements were also made of the recovery time of the maser after it had been fully saturated. The results indicate the degree of improvement required of the duplexer, or the degree of protection that must be provided in addition to the duplexer, if optimum use is to be made of the maser gain characteristics. (Author)

Bartol Research Foundation, Franklin Inst., Swarthmore, Pa.
RESEARCH AND INVESTIGATION OF CATHODE EMISSIVE MATERIALS, by W. E. Danforth and D. L. Goldwater. Scientific rept. no. 7 on Contract AF 19(604)3904. 15 Jan 60, 14p. AFCRC-TN-60-143; AD-234 040.
Order from LC mi$2.40, ph$3.30 PB 146 322

Life studies with thorium impregnated matrix cathodes have been carried to 10,000 hours at the 1.0 amp./sq. cm. level ($1550^{o}C_{B}$); 8,000 hours at 2.4 amp./sq. cm. ($1620^{o}C_{B}$) and 3,400 hours at 3.0 amp./sq. cm. ($1720^{o}C_{B}$). The determination of the surface density of thorium on tungsten corresponding to maximum emission has yielded a value of 4.1×10^{14} atoms/sq. cm. with estimated P. E. of 6%. Bombardment of a thorium-on-tungsten monolayer with electrons of energy of 370 volts has been carried to a total integrated bombardment of 81 amp. hr./sq. cm.

Bendix Radio Div., Bendix Aviation Corp., Baltimore, Md.
INTEGRATED AIRBORNE CNI CONTROL AND DISPLAY EQUIPMENT PROGRAM, by D. G. Erskine and W. D. Philips. Final rept. for 19 Apr 57-4 June 59 on Contract AF 33(600)35175. 4 June 59, 86p. 12 refs. WADC Technical rept. 59-271; AD-235 134.
Order from LC mi$4.80, ph$13.80 PB 149 786

The operational feasibility of an integrated communication-navigation-identification (CNI) control subsystem is discussed. The purpose of this subsystem was to reduce the total amount of critical cockpit area required for the controls of CNI equipments and to simplify their operation, thus relieving the pilot of some of his tasks. The developed subsystem allows the pilot to select and tune most of the CNI equipments with his left hand without visual reference to the primary control panel, which is in the form of a standard adding machine 10-key keyboard. An equipment indicator, located on the instrument panel, is provided for verification of control settings, and appropriate electromechanical devices were incorporated to prevent wrong operation. Tests comparing the operation of the integrated subsystem with the present CNI controls were made, and the results indicate that the subsystem offers an appreciable reduction of the pilot's task with surprisingly little training. Less than half the cockpit area now used for CNI controls is needed for the integrated subsystem. Possibilities of controlling the subsystem from the ground by data link were studied and found feasible and highly desirable for reducing the pilot's work load. (Author)

California U., Los Angeles.
EXTENDED SYNTHESIS TECHNIQUES FOR MULTIPOLE SAMPLED-DATA CONTROL SYSTEMS, by E. B. Stear and C. T. Leondes. Rept. on Contract AF 49(638)438. Oct 59, 16p. 4 refs. AFOSR-TN-59-1223; AD-233 276.
Order from LC mi$2.40, ph$3.30 PB 146 735

The presentation is made of a logical and efficient procedure for the synthesis of multipole sampled-data control systems. It is assumed that the specifications on the system are stated in the time domain, a common situation. It is not assumed in the synthesis procedure presented that the specifications are stated only at the sampling instants of the system, but rather at arbitrary and necessary instants of time. In addition to this, a lower bound is established for the sampling rate based on system requirements. (Author)

Case Inst. of Tech., Cleveland, Ohio.
EVALUATION OF DYNAMIC INTERACTION FIELDS IN A TWO DIMENSIONAL LATTICE, by R. E. Collin and W. H. Eggimann. Scientific rept. no. 12 on Contract AF 19(604)3887. 19 Mar 60, 37p. 2 refs. AFCRC-TN-60-381. AD-237 886.
Order from LC mi$3.00, ph$6.30 PB 148 195

The dynamic interaction fields due to a two dimensional lattice of electric and magnetic dipoles are evaluated. The series involved are summed by means of the Poisson summation formula and other means in order to yield results in closed form. The application of the theory to a disc type artificial dielectric medium is considered. (Author)

Colgate U. [Hamilton, N. Y.]
AN INDUCTIVE RELIABILITY CRITERION FOR RECEIVING SYSTEMS, by Leonard S. Schwartz. Rept. on Contract AF 30(602)2018. Mar 60, 21p. 18 refs. RADC TN-60-3; AD-234 475.
Order from LC mi$2.70, ph$4.80 PB 147 180

Bayes' and Likelihood Tests, used in the detection of signals in noise are reviewed. Their dependence on knowledge of the a priori probabilities and channel statistics is pointed out. An attendant inability to assist in setting decision thresholds when channel statistics are unknown is noted. The nature of a priori information is discussed since prevailing misconceptions concerning this are at the root of much of the weakness of present theories of detection. It is pointed out that the primary aspects of knowledge are a priori and empirical. Only the latter contains probabilistic elements. Possible methods for instrumenting detection systems for both radar and communications operating on principle of inductive probability are discussed. These systems are shown to be potentially capable of achieving any desired degree of reliability, even when operating in a state of almost total initial ignorance regarding channel statistics. (Author)

Compagnie Generale de Télégraphie Sans Fil (France)
SUPERGAIN AND VOLUMETRIC ANTENNAS, by E. Spitz. Technical (Final) rept. on Contract AF 61(052)102. 15 June 59, 74p. 9 refs. AFCRC-TR-59-194; AD-228 779.
Order from LC mi$4.50, ph$12.30 PB 146 389

Research was conducted on the problem of radiating structures placed in a certain limited space. Efforts are based on theoretical work on superdirectional antennas. Two problems are considered: the case of a classical antenna, but developed into volume with all supergain effects excluded and the case of a supergain antenna. The performance is given of a practical form of a built volumetric antenna. Supergain antennas consisting of 5 and 11 sources were calculated, and a method of evaluation is indicated. Five and 11 source supergain structures were built with the individual sources isolated by ferrite unilines. Performances are shown.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
AIR FORCE HANDBOOK: METHODS OF COOLING SEMICONDUCTOR DEVICES, by Steven K. Morrison and James P. Welsh. Rept. on Contract AF 30(602)1842. May 60, 74p. 17 refs. Rept. no. HM-1247-D-5; RADC-TR-60-22, supplement to RADC-TR-58-126.
Order from LC mi$4.50, ph$12.30 PB 148 783

This Handbook was prepared to aid electronic engineers in the thermal design of reliable military electronic equipment. Enumerated herein are recommended principles and techniques for the thermal design of electronic equipment using semiconductor devices. (See also PB 146 874)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
INTERPRETATION OF SOME BACKSCATTER ECHOES IN TERMS OF FIELD-ALIGNED IRREGULARITIES IN THE F REGION, by P. F. Weaver, Jr. Technical rept. no. 49 on Studies on Propagation in the Ionosphere, Contract DA 36-039-sc-78258. 15 Dec 58, 93p. 26 refs. Research rept. EE-389; AD-229 659.
Order from LC mi$5.40, ph$15.30 PB 147 246

Long-range radar echoes at 14 mc were studied which seem to be explicable in terms of direct backscatter from field-aligned irregularities in the F region of the ionosphere. These echoes were regularly observable during the evening hours with a high power pulsed transmitter and a rhombic antenna beamed toward the north. A typical echo was spread in range from about 1000 km to about 2000 km and had a fading rate comparable to that of auroral echoes observed at the same frequency. Because of the observed aspect sensitivity of the echoes, contours of the angle between a plane perpendicular to the earth's magnetic field and ray paths from Ithaca were calculated for F-region heights. These contours of off-perpendicular angle indicated that the observed echoes were coming from an area of near-perpendicularity where angles as low as 9^{o} were found. Because of refraction in the F region, all northward ray paths from Ithaca which would be "reflected" back to earth are bent into perpendicularity at some point along their trajectory. The assumption is therefore made that the observed echoes arise from backscattering by irregularities in the F region elongated along the earth's magnetic field. Calculations on the basis, allowing for refraction and delay time in the F region, lead to echoes at about the observed range. (Author)

David Sarnoff Research Center, Princeton, N. J.
STORAGE LIGHT INTENSIFIER DISPLAY PANEL, by H. O. Hook and W. F. Davidson, Jr. Final rept. 1 Apr 56-30 Sep 58, on Contract DA 36-039-sc-71194. 30 Sep 58, 122p. 5 refs. AD-215 163.
Order from LC mi$6.30, ph$19.80 PB 149 103

Layer type storage light intensifiers with 40 elements per inch were made and performed well. Bi-stable storage for 30 minutes is reported. Less satisfactory results were obtained with more complicated structures. Some characteristics of powdered CdS photoconductors are reported and related to the operation of storage light intensifiers. Spectral match of the 4 RCA electroluminors and CdS photoconductor is almost the same. Optical geometry and absorption in feedback paths are evaluated experimentally and theoretically. (Author) (See also PB 149 366)

Diamond Ordnance Fuze Labs., Washington, D. C.
CONSTRUCTION OF TUBES EMPLOYING PLANAR PERIODIC ELECTROSTATIC FOCUSING, by Burton J. Udelson and McKay R. Bradley. 16 May 60, 31p. 8 refs. Technical rept. TR-828.
Order from LC mi$3.00, ph$6.30 PB 148 464

A new technique has been developed for constructing tubes employing the planar periodic electrostatic focusing of an electron sheet beam. Use of this technique permits the achievement of both mechanical ruggedness and excellent alignment of the electrodes. The technique, in brief, consists in assembling the entire tube structure in separate halves, grinding their surfaces simultaneously with an abrasive wheel, and then bolting the two halves together at each end. Two entirely different methods of assembling the tube halves were developed. Experimental tubes embodying each of these methods were constructed, and each gave excellent beam transmission through the electrostatically focused structure, in one case as high as 99.8 percent. A method of measuring the beam shape and width, and of determining the relative quality of the sheet beam emerging from an electron gun, is described. (Author)

Electric Storage Battery Co., Yardley, Pa.
INVESTIGATION OF AgO PRIMARY BATTERIES, by P. Ruetschi and R. F. Amlie. Quarterly rept. no. 2, 1 Sep-30 Nov 59, on Contract DA 36-039-sc-78319. [1959] 21p. AD-233 532.
Order from LC mi$2.70, ph$4.80 PB 147 974

Electroformed and pasted AgO plates were compared by discharging at the 10-hr rate (300 ma, for the particular size plates used). Various techniques of fabricating and electroforming AgO plates made by the ESB "DP-Process" were studied to obtain improved discharge efficiencies. Theoretical discharge efficiencies of about 91% were realized with the best electroformed plates; this efficiency value is the same as that realized from plates of commercial silver (II) oxides, made with chemically prepared AgO. The influence of sintering temperature was studied on DP-Process electrodes made of discrete Ag particles of about 1μ. This parameter was relatively critical since the discharge efficiency was optimized by keeping the sintering temperature low, at 450° to 500°C. The effect of total charge input was also investigated by charging at several current densities ranging from approximately 4 to 1 ma/cm^2. About 90% of the theoretical capacity was realized with a 75% overcharge and capacity increase was very small with additional charging. The voltage cut-off meter-relay unit was completed and put into operation. Efforts were greatly facilitated by this instrument which automatically interrupts the current at the end of charge or discharge at a present voltage level. Two or more electrodes can be discharged per day on the laboratory bench with a minimum of attendance to give an accurate record of voltage and elapsed time.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
THE DEVELOPMENT AND EVALUATION OF A PANORAMIC RADIO DIRECTION FINDING RECEIVER, by Edward E. Kellum. Technical rept. no. 14 on Contract Nonr-1834(02). 25 Sep 59, 61p. 31 refs. AD-228 194.
Order from LC mi$3.90, ph$10.80 PB 148 599

A panoramic radio direction finding receiver is a device that enables an operator to determine the direction of arrival and frequency of any received signal over a specified bearing sector and frequency band. The purpose of this investigation is to determine the performance of the receiver when used for direction finding. Test results indicated that panoramic radio direction finding is not useful if only a Watson-Watt type of display is used. It is essential that a bearing converter be used; however, the bearing converter used in this test is not satisfactory because of the bearing spread. Methods to lessen the bearing spread are (1) decreasing the IF amplifier bandwidth in the receiver, (2) increasing the intermediate frequency in the bearing converter, and (3) triggering the timing pulse circuit only when the frequency in the bearing converter is the correct frequency. These methods are discussed in the experimental results. A block diagram and description of method (3) above is given.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
EVALUATION OF A LABORATORY MODEL INJECTION TYPE RDF RECEIVER, by Harry A. Shubert. Technical rept. no. 12 on Contracts Nonr-1834(02) and DA [36] 039-sc-74898. 31 Mar 59, 47p. 2 refs. AD-225 274.
Order from LC mi$3.30, ph$7.80 PB 146 357

Descriptions and data are presented on the construction and operation under laboratory conditions of a 2-channel radio direction finding (RDF) receiver matched in phase and gain automatically. The channels are matched by means of a signal injection system. Schematic diagrams, explanations of operation, and photographs and analysis of results are presented. A review of the general principles of operation of a direct reading RDF system with emphasis on the details pertinent to this project is given. An attempt was made to show why the requirements on the receiver are very rigid. The principles of operation of the injection system for channel matching, and an explanation of the construction of the system used are outlined. An analysis is presented of results obtained, in which the results are compared to theoretical calculations and curves. (Author)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
NEW TECHNIQUES IN SWITCHING CIRCUIT SYNTHESIS, by Donald Lee Epley. Doctoral thesis. Technical note no. 13 on Contract AF 49(638)63. 1 May 60, 103p. 42 refs. AFOSR-TN-60-614.
Order from LC mi$5.70, ph$16.80 PB 148 765

Three new switching theory concepts and methods analogous to electrical network theory methods are defined and applied to problems in switching circuit synthesis. The first, the removal synthesis technique, is used to synthesize transmission contact networks with p input terminals and q output terminals. Transmission contact networks are synthesized to realize a transmission matrix containing switching functions between each input-output terminal pair. The second new concept introduced is the 0, 1-configuration of a switching function. Using this representation of switching functions and a mapping procedure, a new method of finding the minimum sums of a given function is developed. The third concept, sensitivity of a contact circuit to contact errors, is used to design circuits with error protection. Two different sensitivities, contact and condition, are defined. Contact sensitivity is used to develop a design procedure for the single contact error and equally likely input combinations case. Condition sensitivity is used in a similar design procedure applicable to multiple contact error case and which includes differences in likelihoods of occurrence of input combinations.

Electron Tube Research Lab., U. of Minnesota, Minneapolis.
STUDIES ON BASE NICKELS FOR OXIDE-COATED CATHODES, by D. E. Anderson. Scientific rept. nos. 5 and 6, 15 Apr-15 Oct 59, on Contract AF 19(604)3890. [1959] 97p. 3 refs. AFCRC TN-60-112.
Order from LC mi$5.40, ph$15.30 PB 146 327

An investigation was made of the applied voltage and diode current (I-V characteristics) of thermionic diodes under μsec pulse conditions. Studies were made of the influence of diode spacing and of deviations from parallel-plane geometry on the observed emission and coating resistance. A new system was developed for the controlled reduction of oxide coatings using a C-Ni diffusion couple. Oxide cathodes based on 0.22% and 0.08% Al-Ni alloys exhibited stable emission levels of over 11 amp/sq cm for operating times of over 5000 hr at 1093°K. The activation of passive-based cathodes exposed to a constant Ba pressure produced appreciable enhancement of emission. Studies of the influence of a heated Ti anode on the emission from an oxide cathode revealed no interaction except when the anode was heated directly over the cathode. (See also PB 143 974)

Electronic Communications, Inc., Timonium, Md.
FERRITE PHASE SHIFTER FOR THE UHF REGION. PART II, by C. M. Johnson and G. V. Buehler. Scientific rept. no. 2, 2 May 58-30 Sep 59, on Contract AF 19(604)2407. 31 Oct 59, 77p. 6 refs. AFCRC TN-60-138; AD-234 145.
Order from LC mi$4.50, ph$12.50 PB 146 324

Ferrite properties which influence phase shifter performance were investigated, and improved versions of the ferrite-loaded, folded-stripline, UHF phase shifter were constructed. Some theoretical relations were derived from conventional ferromagnetic theory to explain the performance of this type of phase shifter, but good quantitative agreement with the experimental results was not attained. This disagreement is attributed to demagnetizing effects. A preliminary investigation was made to determine the nature of these effects and some of the results are included. (Author) (See also PB 137 478)

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
A CIRCUIT FOR BROAD-BAND IMPEDANCE MATCHING OF A PAIR OF LOADS, by James J. Epis. Rept. on Contract DA 36-039-sc-71053. 26 Feb 58, 34p. 2 refs. Technical memo. no. EDL-M129; AD-158 648.
Order from LC mi$3.00, ph$6.30 PB 147 438

A circuit is described in which two loads are coupled to a common transmission line. The circuit, in itself incorporates often-used circuit elements; as a result of the manner in which these elements are inter-connected the transmission line to the generator does not have reflected waves, or standing waves, regardless of the impedance mismatches of the two loads. Thus, the signal generator operates into a perfectly matched system, and undesirable interactions between the loads and the generator do not occur. In many cases, this operation can be maintained over a broad frequency band. The theoretical analysis developed for the circuit is verified by experiment, and several useful and practical applications of the circuit are considered. (Author)

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
HEATER INDUCED FREQUENCY MODULATION IN THE QK-518 BACKWARD WAVE OSCILLATOR, by J. F. Lipman. Rept. on Contract DA 36-039-sc-73170. 18 Oct 57, 16p. Technical memo. no. EDL-M119; AD-161 274.
Order from LC mi$2.40, ph$3.30 PB 147 437

An experimental study has been made on several QK-518 backward wave oscillator tubes to determine frequency modulation characteristics with ac heater power. One source of frequency modulation is resistance in the common heater-cathode lead within the tube. A second source appears to be attraction of electrons by the heater on the positive half cycle, thereby causing frequency pushing. These two effects are opposite. A typical tube has about a 1.5-megacycle deviation at the low-frequency end of the band. As the frequency is increased toward the high frequency end of the band, the deviation decreases to zero, reverses in phase and increases to about one megacycle. (Author)

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
INVESTIGATION OF THE FEASIBILITY OF A BROADBAND WAVEGUIDE ROTARY JOINT USING CIRCULAR POLARIZATION, by P. D. Cogshall.

Rept. on Contract DA 36-039-sc-75012. 23 Mar 59, 32p. 10 refs. Technical memo. no. EDL-M171; AD-215 073.
Order from LC mi$3.00, ph$6.30 PB 147 440

Circular polarization techniques in round and square waveguide are studied for application in a broadband rotary joint. Broadband quarter-wave plates are constructed and assembled in an experimental rotary joint in S-band. Characteristics of resonant conditions and methods of eliminating them are investigated. Resonant slots are used to suppress resonances by absorbing the orthogonal mode in a round waveguide rotary joint. The peak power capability is determined in an X-band model by measuring the breakdown power in a waveguide resonant loop. The measurement techniques are discussed. (Author)

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
AN INVESTIGATION OF UHF SPECTRA OF SINGLE CRYSTALS OF $BaTiO_3$, by Howard Diamond. Rept. on Contract DA 36-039-sc-73170. 15 Apr 58, 11p. 7 refs. Technical memo. no. EDL-M135; AD-161 275.
Order from LC mi$2.40, ph$3.30 PB 147 439

The need for spectral information on good, single crystals of $BaTio_3$ is emphasized. The frequency range from 65 to 300 mc is investigated using a method which continuously displays dielectric constant versus frequency; the particular range was chosen to check a previously reported resonance at 120 mc. Using spectrographic techniques, no such resonance was found. In the frequency and temperature range considered, the crystal showed a gradual reduction of dielectric constant at the higher frequencies. (Author)

Electronics Research Lab., U. of California, Berkeley.
AN ITERATIVE APPROXIMATION TO FLAT DELAY IN AN EQUAL RIPPLE MANNER, by Charles A. Kulmann. Rept. on Contract N7onr-295(29). 15 June 59, 31p. 5 refs. Rept. no. 89; Series no. 60, issue no. 242; AD-233 099.
Order from LC mi$3.00, ph$6.30 PB 146 582

To date, there has been no analytic solution to the equal ripple delay function; the data presented here is the result of iterative solutions using a high-speed digital computer. In addition to the obvious use for precision delay line design, the results of this paper may also be used in the design of pulse amplifier interstage networks. Since phase distortion in an amplifier will result in dispersion of the transmitted pulse and the resultant difficulty in the resolution of closely spaced pulses, it is desirable to concentrate on the phase (or delay) characteristic. In this paper, the desired constant delay time is approximated in an equal ripple manner over the useful band of frequencies. Results are given in graphic form for orders of approximation up to $N = 12$ and for values of delay ripple from 0.01% to 10% for a normalized bandwidth of $0 \leq \omega \leq 1$. Denormalization techniques for both low-pass and band-pass cases are outlined in examples. (Author)

Electronics Research Lab., U. of California, Berkeley.
A MICROWAVE ANECHOIC CHAMBER, by F. D. Clapp and D. J. Angelakos. Rept. on Contract N7onr-29529. 21 Sep 59, 13p. 3 refs. Rept. no. 90; Series no. 60, Issue no. 251; AD-235 449.
Order from LC mi$2.40, ph$3.30 PB 148 622

Study of the data leads to the conclusion that the room is about equally effective with the walls either straight or corrugated, with the provision that if the walls are straight, the antenna must be placed in an asymmetrical position in the room. If the walls are corrugated, it is essential that angular joints in the corrugations be suitably covered to prevent additional reflections. If these stipulations are followed, spurious reflections should be at least 20 db down from the main lobe at any angle, and will be considerably better for most cases. This is obviously not good enough for investigation of small side-lobe arrays but is adequate for many purposes.

Emerson and Cuming, Inc., Canton, Mass.
DIELECTRIC EMBEDDING MATERIAL FOR 500°C SERVICE. Final rept. for 1 July 57-31 Mar 58 on Contract NObs-72339. 1 Apr 58, 27p. AD-218 998.
Order from LC mi$2.70, ph$4.80 PB 148 852

A survey of possibly useful commercially available materials and a literature search revealed that the major part of the problem was bonding material suitable for this temperature service. A number of promising types were experimentally evaluated in various modifications. A silica gel bond and a low melting lead glass bond were found most useful. With further development, these materials can be used for the contemplated tasks. A program for further work is included. (Author)

General Electric Microwave Lab., Palo Alto, Calif.
MEASUREMENT AND CONTROL OF HARMONIC AND SPURIOUS MICROWAVE ENERGY, by Vernon G. Price, John P. Rooney, and Richard H. Stone. Final rept., Change A, for July 59-Jan 60 on Contract AF 30(602)1670. 18 Mar 60, 75p. 8 refs. Technical Information Series rept. R60ELM112-4; RADC-TR-60-77.
Order from LC mi$4.50, ph$12.30 PB 148 534

Leaky wall filters were fabricated and are reported herein. A design for a coaxial probe section (to be used in the rotating joint of a radar system) is reported. This probe section is designed to measure the harmonic energy to the fift'. harmonic whether the signals are propagating in either the forward or reverse direction. It is to be noted that all of the harmonic energy in a radar system must pass through the rotary joint (if the radar has one), and hence this is a unique place to make measurements. Measurements were made ot the harmonic output of the VA-125 traveling-wave tubes and are reported herein. Thus, limited data are now available on magnetrons, klystrons, and traveling-wave tubes. (See also PB 145 604)

General Electronic Labs., Inc., Cambridge, Mass.
1000 TO 3000 MC RECEIVER FRONT END, by Martin W. Levine. Final technical rept. for 1 May 56-30 June 59 on Contract DA 36-039-sc-72326. [1959] 69p. 1 ref. E-136-F; AD 226 296.
Order from LC mi$3.90, ph$10.80 PB 146 546

The development is presented of a 1000-to 3000-mc front end for providing the tuning function for a radio interference and field strength measuring set (AN/URM-85) and which incorporates the latest design features. A survey into the current state of the art revealed design features which could lead to the development of a receiver front end with superior performance characteristics. A system concept was developed which exploited these design features and a design approach for an experimental model of a 1000-to 4000-mc front end was prepared. After fabrication of the experimental model, and evaluation indicated that the performance of this design with minor modificatfons would comply with all the required performance criteria. After modifying this design, 2 service test models of the 1000 - to 4000-mc front end were fabricated, evaluated and found to meet the objectives of the technical requirement. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION ON THE AGING EFFECTS RESULTING FROM PLATING METHODS AND MATERIALS, by Richard B. Belser. Quarterly rept. no. 1, 1 Apr-1 July 54, on Contract DA 36-039-sc-56753. [1954] 40p. 4 refs.
Order from LC mi$3.00, ph$6.30 PB 138 211

Studies of aggregation and physical properties of sputtered films of platinum metals, molybdenum, chromium, aluminum and gold.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION ON THE AGING EFFECTS RESULTING FROM PLATING METHODS AND MATERIALS, by Richard B. Belser and Walter H. Hicklin. Quarterly rept. no. 3, 1 Oct 54-1 Jan 55, on Contract DA 36-039-sc-56753. [1955] 51p. 1 ref.
Order from LC mi$3.60, ph$9.30 PB 138 212

Positive-ion bombardment of glass and quartz substrates and its effects on the adherence and the aging of gold, silver and aluminum films deposited thereon by sputtering and evaporation. Films deposited on substrates, which were subjected to bombardment before deposit and aged by heating thereafter, were remarkably free of bubbles and pin holes common to films deposited on substrates which were not subjected to bombardment. Behavior of bimetal films indicate that these films hold much interest for studies of diffusion and the behavior of metals but that only selected metal pairs, of proven stable performances, should be given serious consideration as coatings for quartz resonators. (See also PB 138 211)

I. T. E. Circuit Breaker Co., Philadelphia, Pa.
ANTENNA CONTROL GROUP ANDB TYPE 2. 3NS6. Technical manual. Rept. on Contract NObsr-64741. 11 Dec 56, 133p. NAVSHIPS 92913.
Order from LC mi$6.90, ph$21.30 PB 147 953

The Antenna Control Group Type 2. 3NS6 consists of an antenna pedestal with servo control suitable for use with the Antenna Assembly 2. 3NS3 and a 30 foot antenna similar to the 2. 3NS3. The control group has been primarily designed to automatically slave a master antenna unidirectionally up to a maximum velocity of 26 rpm.

ITT Labs., Nutley, N. J.
INVESTIGATION OF ELECTRICALLY VARIABLE DELAY LINES, by S. R. Hoh and G. R. Leef. Final rept. on Contract AF 30(602)1859. Jan 60, 52p. 9 refs. RADC-TR-59-214; AD-231 095.
Order from LC mi$3.60, ph$9.30 PB 146 597

Electrically variable delay lines based on ferroelectrics were investigated analytically and experimentally. This work was supported by evaluations of available materials as well as by a material development program. A material Q of 100 was obtained with a barium-strontium titanate which is the highest ever reported in this frequency range. A new multisection delay line was developed incorporating ferroelectrics. This line has an attenuation comparable to standard delay cables and, in addition, miniaturization and controllability. (Author)

Lincoln Lab., Mass. Inst. of Tech., Cambridge.
DOPPLER PHASE-DIFFERENCE INTEGRATOR, by G. M. Hyde and K. E. Perry. Rept. on Contract AF 19(122)458. 12 Nov 58, 34p. 2 refs. Technical rept. no. 189; AD-206 258.
Order from LC mi$3.00, ph$6.30 PB 148 369

The Doppler phase-difference integrator is a type of constant false-alarm rate (CFAR) detector that operates by integrating unit vectors formed on the phase difference between successive target return pulses from the receiver of a phase-coherent radar. The detection process is accomplished mainly by means of digital circuitry. Since it has been found that for successful detection a fairly large number of hits on target (50 or more) are necessary, the device is not adaptable to all radars. However, this detector does show some interesting features in the ability to map out ground clutter and in the possibility of plotting wind velocities in storm clutter. (Author)

Little, Arthur D., Inc., Cambridge, Mass.
RESEARCH INVESTIGATION OF REFLECTIVE WALL COATINGS FOR MICROWAVE RESONATORS. Quarterly rept. no. 5, 15 Mar-15 June 58, on Contract DA 36-039-sc-73143. 15 July 58, 28p.
Order from LC mi$2.70, ph$4.80 PB 147 178

This report discusses our experimental investigation of the relaxation of optically oriented sodium atoms. Experimental data are presented on the relaxation time at various buffer gas pressures in an unlined glass cell and a polyethylene-lined cell. Analysis of the experimental results indicates that polyethylene definitely inhibits the wall relaxation of the aligned atoms. (See also PB 145 405)

Materials Research Lab., Watertown Arsenal, Mass.
SIMPLE METHOD OF RECORDING FREQUENCY IN NUCLEAR MAGNETIC RESONANCE STUDIES, by J. A. Hofmann and P. L. Sagalyn. June 60, 7p. MRL rept. no. 77.
Order from LC mi$1.80, ph$1.80 PB 148 409

In studies of broad nuclear magnetic resonance lines where the line is scanned by varying the spectrometer frequency, deviations from frequency sweep linearity can produce significant errors in the measured areas, second moments, etc., unless frequency markers are recorded along side the resonance curve at sufficiently small frequency intervals. This note describes a convenient, relatively automatic system for recording such frequency markers, using commercially available equipment.

Melabs., Palo Alto, Calif.
RESEARCH AND DEVELOPMENT OF A SOLID STATE PARAMAGNETIC MASER, by Roy W. Roberts and Harold D. Tenney. Quarterly progress (scientific) rept. no. 7, 10 Dec 59-9 Mar 60, on Contract AF 19(604)4071. 9 Apr 60, 37p. 12 refs. AFCRC-TN-60-552.
Order from LC mi$3.00, ph$6.30 PB 148 403

Theoretical calculations showing the effects of various types of cross relaxation mechanisms on maser inversion ratio are given. Examples of three spin, four spin, and five spin processes are given and the results compared to experiments which have been described in the recent literature. Transient solutions of the rate equations are obtained and methods of measuring the cross relaxation probability described. The design of a superconducting iron-cored electromagnetic is described. It is anticipated that this magnet will allow the use of longer slow-wave structures than are possible with the conventional laboratory electromagnet. (Author) (See also PB 146 323)

Michigan U. Research Inst., Ann Arbor.
AN INTRODUCTION TO THE PRACTICAL APPLICATION OF FERROELECTRICS, by T. W. Butler, Jr. Technical Memo. no. 61 on Contract DA 36-039-sc-63203. Oct 58, 26p. 7 refs. 2262-191-T; AD-208 107.
Order from LC mi$2.70, ph$4.80 PB 147 225

Properties of ferroelectric materials and to physical principles involved in their applications. Three groups of applications which make use of (1) the high permittivity, (2) the nonlinear properties and (3) electro-mechanical properties are discussed. Applications utilizing the nonlinear properties are of much greater interest to the electrical engineer.

Michigan U. Research Inst., Ann Arbor.
LARGE-SIGNAL ANALYSIS OF CROSSED-FIELD DEVICES, by O. Gandhi and J. E. Rowe. Semiannual progress rept. no. 1, 1 Sep 58-1 Mar 59, on Contract DA 36-039-sc-78223. Aug 59, 46p. 14 refs. 2820-1-P; AD-228 064.
Order from LC mi$3.30, ph$7.80 PB 147 992

A large-signal theory for planar crossed-field amplifiers and oscillators is developed in which the effects of space charge, circuit loss and finite values of the gain parameter D are accounted for. The working equations are formulated from the Lorentz force equation, the continuity equation and a transmission-line equation developed from the equivalent circuit for the RF structure. The space-charge force between electrons is calculated using a Green's function method for essentially point charges in the interaction region. The equations are valid for thick streams. The working equations will subsequently be solved as an initial boundary-value problem. The dependent variables and their derivatives will be given at the input boundary. The initial conditions are specified. (Author)

Michigan U. Research Inst., Ann Arbor.
LARGE-SIGNAL ANALYSIS OF CROSSED-FIELD DEVICES, by O. Gandhi and J. E. Rowe. Semiannual progress rept. no. 2, 1 Mar-1 Sep 59, on Contract DA 36-039-sc-78223. [1959] 47p. 2 refs. 2820-2-P; AD-232 554.
Order from LC mi$3.30, ph$7.80 PB 147 993

A numerical procedure for the solution of the large-signal crossed-field equations is developed and the differential equations are transformed into difference equations. A flow diagram is developed to illustrate the iterative method of solving the equations. The large-signal results are compared with results from a small-signal theory and it is determined that the agreement is good within the limitations of the small-signal theory assumptions. A study of truncation error is presented. The effect of cyclotron waves is considered and the accuracy of replacing the slow-wave structure with an infinitely conducting sheet for space-charge field calculations is evaluated. (Author) (See also PB 147 992)

Michigan U. [Research Inst.] Ann Arbor.
REDUCTION OF SIGNAL-TO-NOISE RATIO WITH RANGE FOR PbTe AND THERMISTOR DETECTORS, by A. LaRocca and G. Zissis. Rept. on Proj. Michigan [Contract DA 36-039-sc-52654]. July 56, 23p. 1 ref. 2144-246-T; AD-201 131.
Order from LC mi$2.70, ph$4.80 PB 146 563

When contrast signal was used to obtain signal-to-noise values, the S/N of a PbTe cell decreased with range at a much faster rate than did the S/N of a thermistor. Contrast signal is the signal resulting from the experimental idealization of target and background produced by using two sources of known emissivity to furnish the radiation used for measurement of S/N. (Author)

Michigan U. Research Inst., Ann Arbor.
RESEARCH ON CROSSED-FIELD ELECTRON DEVICES, by R. W. Larson, R. J. Martin and others. Quarterly progress rept. no. 4, 1 Sep-1 Dec 59, on Contract DA 36-039-sc-78260. [1959] 48p. 6 refs. 2854-5-P; AD-233 439.
Order from LC mi$3.30, ph$7.80 PB 147 968

A discussion of the initial experimental tests on the crossed-field stream analyzer with the potential trap

in the sole is presented and some analog computer calculations of electron trajectories through the trap are given. A general verification of previous results has been obtained. Extensive calculations of heating-wave amplification in the presence of beam space-charge and circuit loss are given and the significance of the results is discussed. Starting conditions for the M-type BWO are obtained when d=0 and some interesting aspects with regard to their dependence on H and r are commented on. A generalized analysis of the two-beam crossed-field amplifier is developed in which the slip between the two beams is accounted for. A physical interpretation of the growth mechanism in such a device is offered. (Author)

Microwave Associates, Inc., Burlington, Mass.
VARIABLE CAPACITANCE MICROWAVE DIODE. Quarterly progress rept. no. 3, 1 May-31 July 59, on Contract DA 36-039-sc-78236. [1959] 49p. 10 refs. AD-229 343.
Order from LC mi$3.30, ph$7.80 PB 146 456

The negative-resistance varactor amplifier is analyzed. Amplification is possible for any ratio of signal frequency to cutoff frequency. As this ratio increases, the admissible range of pump frequency narrows and the noise figure increases; also, the "gainwidth" (the range of possible signal frequencies for a given pump frequency) narrows. The first samples of hermetically sealed varactors have passed all required environmental tests. (Author) (See also PB 145 960)

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
HIGH POWER MICROWAVE SWITCH, by S. J. Tetenbaum. Quarterly progress rept. no. 4, 16 Mar-15 June 59, on Contract DA 36-039-sc-78044. 30 July 59, 16p. AD-228 198.
Order from LC mi$2.40, ph$3.30 PB 146 533

Satisfactory construction techniques have been developed for both the forsterite and synthetic mica switch tubes. The major problem associated with the latter tube is that the raw material is non-uniform, both from block to block and within a block, and most of the raw material was slightly porous, making it unusable as a vacuum envelope. High power measurements performed on forsterite switches with and without metal gaskets and with Helium, Argon and Neon gas fillings, have shown that except for life, the switches meet the acceptable requirements. The switches exhibited short life due to excessive gas cleanup and a rapid variation of the breakdown power with time. Possible reasons for these effects are discussed and changes in tube construction are suggested for improving the switch life. The electromagnetic and switching power supply have been constructed and tested. They meet all requirements. (Author) (See also PB 145 809)

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
HIGH POWER MICROWAVE SWITCH, by S. J. Tetenbaum. Final rept. for 15 June 58-31 Aug 59 on Contract DA 36-039-sc-78044. 1 Nov 59, 51p. 4 refs. AD-230 934.
Order from LC mi$3.60, ph$9.30 PB 148 335

A high power cyclotron resonant gas switch covering the 2.7 to 3.7 kmc band was designed and tested. Three different discharge tubes were investigated. An encapsulated window tube was unsatisfactory because the available windows tended to crack at high average powers. A synthetic mica tube was unsatisfactory because the raw material was non-uniform and tended to be porous. A forsterite tube was readily fabricated and exhibited satisfactory electrical properties. The major obstacle to the practical use of the forsterite switch is its short life, being only about 40 hours even with a 500 cc gas reservoir. This is due to excessive gas cleanup, probably caused by ion trapping in the tube walls. Changes in design and construction are suggested which offer promise of increasing switch life. (Author) (See also PB 146 533)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
THE SCANNING PROCESS IN PICTURE TRANSMISSION, by A. E. Laemmel. Rept. on Contract AF 30(602)1471. 29 Mar 57, 51p. 23 refs. Rept. R-563-57, PIB-491; RADC TN-57-215; AD-131 112.
Order from LC mi$3.60, ph$9.30 PB 146 371

This report examines several fundamental aspects of the picture scanning process used in electrical facsimile or telephoto systems. In particular, scanning processes are analyzed with respect to the relation between the required time-bandwidth product and the unavoidable degradation of resolution which usually results. Upper bounds on the performance of such systems are given, together with several improved methods of scanning which hold promise of getting closer to ideal conditions than those presently in use. All of the results obtained are completely independent of the picture statistics and number of gray levels used, so that they may be used alone with any sort of copy, or together with a coding or mapping process with more restricted types of copy. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
SOME STATISTICS CONCERNING TYPEWRITTEN OR PRINTED MATERIAL, by Sid Deutsch. Rept. on Contract AF 30(602)1471. 31 Oct 56, 29p. Rept. R-526-56; PIB-456; RADC TN-57-22; AD-114 236.
Order from LC mi$2.70, ph$4.80 PB 146 372

The first set of statistics assumes that the original sample is composed of discrete resolution elements that are binary quantized and .01 inch square. The second set of statistics assumes that the original sample is binary quantized and continuously scanned in a vertical direction along lines that are .01 inch apart. The third set of statistics assumes that the original sample is composed of discrete resolution elements that are binary quantized and .01 inch square. The fourth set of statistics again assumes discrete quantized square elements.

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
CRYSTAL DETERIORATION STUDIES, by P. P. Lombardini, R. J. Doviak, and H. Kritikos. Final rept. Task 2 on Contract AF 30(602)1615.

15 Apr 58, 172p. 185 refs. Rept. no. ES-28-030-05; RADC TR-58-95; AD-148 811.
Order from LC mi$8.10, ph$27.30 PB 146 367

A study of deterioration of microwave crystal rectifiers was conducted in two phases. In Phase A an experimental investigation was undertaken to determine the threshold power levels needed for partial and total burnout under conditions of different pulsewidths and exposure time. A new indicator of crystal burnout was developed. Phase B was concerned with a critical review of the available literature on crystal burnout.

Moore School of Electrical Engineering, U. of Pennsylvania, Philadelphia.
INTERFERENCE STUDIES, by O. M. Salati, R. A. Rosien and others. Final rept. Task 1, vol. 1, 15 Aug 56-15 Apr 58, on Contract AF 30(602)1615. 15 Apr 58, 210p. 38 refs. Rept. no. ES-27-030-05; RADC-TR-58-96; AD-148 812.
Order from LC mi$9.30, ph$31.80 PB 146 366

This report presents the results of research on the theory of interference prediction and interference measurement techniques. Eight separate sections are devoted to permissible interference levels or susceptibilities, data presentation, methods and devices for measuring spurious and harmonic radiation, out of band pulsed and CW interference in a microwave receiver, loss of radar information due to blanking, bandwidth conservation in pulsed radars, graphical techniques for great circle calculations, comments on military interference specifications, and prevention of moding in magnetrons.

National Research Labs., Ottawa (Canada).
ANALYSIS AND COMPUTER STUDY OF AN ADAPTIVE CONTROL SYSTEM, by D. A. Dawson. Sep 59, 95p. 8 refs. Mechanical Engineering rept. MK-4.
Order from LC mi$5.40, ph$15.30 PB 148 080

The concept of total cost or economic penalty is formulated for adaptive control of regulators. The cost is assumed to be a function of the error and the manipulated variable, although the function need not be known a priori. A circuit is then described which will optimize the system, that is, will vary the gain of the controller so as to bring it towards the value associated with the minimum total cost. The results of an experimental study are included which describe the effect of variations of the parameters of the adaptive circuit on the over-all behaviour. It is found that with such a circuit the gain oscillates about the optimum value while the cost oscillates around some value above the minimum possible value. An attempt is made to define quantities which describe the effectiveness of such adaptation. The adaptive system is also modified so as to optimize with respect to two controller variables. (Author)

Naval Ordnance Lab., White Oak, Md.
A CONTINUOUS OSCILLOGRAPHIC METHOD FOR THE DETERMINATION OF DETONATION VELOCITIES IN SOLID CAST EXPLOSIVES, by Adolph B. Amster, Paul A. Kendall and others. 16 Mar 59, 15p. 10 refs. NAVORD rept. 6280; AD-225 615.
Order from LC mi$2.40, ph$3.30 PB 148 454

The continuous electronic measurement of detonation, velocities in solid cast explosives is made possible by using a new technique. A fine nichrome wire is cast within and parallel to the long axis of a confined explosive. A record of its resistance during detonation serves to locate the ionization front associated with detonation. The measurement is recorded on an oscillograph. From the photograph of this record, instantaneous detonation velocities are measured to within ±2%. This new method makes possible study of the development, stability, and decay of detonations by non-optical means. (Author)

Naval Ordnance Lab., White Oak, Md.
A FREQUENCY-MODULATION MAGNETIC-TAPE PLAYBACK SYSTEM, by D. J. Torpy. 1 Aug 58, 22p. NAVORD rept. 6156; AD-206 317.
Order from LC mi$2.70, ph$4.80 PB 147 226

Data recording systems which make use of frequency-modulation of a carrier signal recorded on magnetic tape are subject to noise resulting from speed variations in the recording or playback mechanisms. This report describes a playback system which reduces this noise by utilizing a constant-frequency reference signal recorded simultaneously with the data signal, but on a different channel of the tape, to obtain a measure of the speed variations. By using this information, the system reduces the noise to a fixed level which is independent of the magnitude of the speed variations. (Author)

Naval Research Lab., Washington, D. C.
THERMOELECTRICITY, by J. W. Davisson and Joseph Pasternak. Status rept. no. 4. Mar 60, 182p. 2 refs. NRL Memo. rept. 1037.
Order from LC mi$8.40, ph$28.80 PB 147 307

A thorough review of the status of thermoelectricity was provided by a conference held at the Bureau of Ships in December. Each activity described its contracts and evaluated the progress that had been made on them. All of these contracts are described in the final section of this report. Another meeting was a symposium presenting new materials prospects to complement the array of engineering studies. Most of the attention was devoted to refrigeration, but feasibility of a variety of other applications including such things as distillation and pumping were also discussed. (See also PB 145 603)

Navy Electronics Lab., San Diego, Calif.
ANTARCTIC PHOTOMETRY FOR THE DEVELOPMENT OF AN ICE RECONNAISSANCE TELEVISION, by J. M. Hood, Jr. 6 Apr 59, 20p. 2 refs. Research and Development rept. 904; AD-220 475.
Order from LC mi$2.40, ph$3.30 PB 148 644

A series of photometric measurements were made in the Antarctic to assist in the development of a helicopter-borne ice-reconnaissance television. A detailed photometric description of the environment is presented along with broad recommendations for the functional design of a suitable television system. A detail brightness range of 20 to 1 and meteorological

ranges as high as 75 naut mi were measured. Recommendations are made for a system having a 600-to-800 line scan with a minimum video bandwidth of 10 Mc. A single fixed lens of 1-in focal length in combination with the standard 1-in vidicon should give good area coverage and stable observer orientation. (Author)

New York U. Coll. of Engineering, N. Y.
THE CORRELATION PROCESS, by B. Harris and L. S. Schwartz. Technical note on Contract AF 30(602)1655. 15 Apr 59, 65p. 19 refs. RADC-TN-59-145; AD-214 598.
Order from LC mi$3.90, ph$10.80 PB 147 301

Three aspects of the process are considered: (1) The application of inductive probability to the correlator to improve the performance as a sequential detector, as well as to permit the automatic assimilation of a priori knowledge into the decision. (2) The expansion of the correlation function in a series of orthognal functions whose coefficients are determined by linear passive elements. This permits the cross-correlation function to be determined by a smaller bank of coefficient detectors instead of a large bank of parallel correlators. In this method the correlation function can be displayed by impulse triggering the corresponding circuit. (3) Pattern recognition as a means of determining whether or not the cross correlation function indicates the inputs are correlated. Further development of this idea is required before its usefulness can be determined.

New York U. Coll. of Engineering, N. Y.
ENERGY RELATIONS IN FEEDBACK CONTROL SYSTEMS CONTAINING A NON-LINEAR ELEMENT, by Richard Wolfson. Rept. on Contract AF 49(638)586. Jan 60, 52p. 4 refs. Technical rept. 400-7; AFOSR-TN-60-17; AD-232 433.
Order from LC mi$3.60, ph$9.30 PB 147 337

Equations among the average output powers in a single-loop, non-linear feedback control system are developed. These "energy distribution equations" have a form that relates summations of the output power at all frequencies in the non-linear network, to circuit responses calculated at the source frequencies.

New York U. Coll. of Engineering, N. Y.
INFORMATION FLOW CRITERIA FOR FEEDBACK CONTROL SYSTEMS, by S. S. L. Chang. Rept. on Contract AF 49(638)586. Jan 60, 33p. 5 refs. Technical rept. 400-8; AFOSR-TN-59-1328; AD-231 893.
Order from LC mi$3.00, ph$6.30 PB 146 715

Information capacity in Shannon's sense is suggested as an additional criterion for control systems and components. This criterion applies equally well to linear as well as nonlinear systems, and enables a designer to determine the tolerable amounts of small signal nonlinearities in components. Equations are derived for calculating required system capacity from given signal properties and allowed error, loss of information rate in system components, required capacities of system components, and calculation of information capacities from the characteristics of system components with either direct or indirect limiting. (Author)

Ohio State U., Columbus.
PROCEEDINGS OF THE OSU-WADC RADOME SYMPOSIUM, by Robert Fouty and W. A. Greene. Rept. on Radome Techniques and Components, Contract AF 33(616)5410. June 58, 764p. 141 refs. WADC Technical rept. 58-272, vol. I; AD-155 831.
Order from LC mi$11.10, ph$102.90 PB 149 186

This report is one of three containing the papers submitted for the 1958 Radome Symposium. The papers contain technical information pertaining to the design, fabrication, and testing of radomes for ground and airborne use. (Author)

Ohio State U. Research Foundation, Columbus.
THE ANALYSIS AND PRODUCTION OF DENSE ELECTRON BEAMS FOR USE IN MICROWAVE TUBES, by R. M. Campbell. Final rept. on Contract AF 18(600)980. Mar 60, 104p. 9 refs. AFOSR-TR-60-50.
Order from LC mi$5.70, ph$16.80 PB 147 771

Several mathematical methods of analysis were studied and a pinhole-camera gun tester was built. Of the mathematical methods studied, a relaxation method in conjunction with a resistance analog network appeared to be the most useful. A paraboloidal-spheroidal gun, a nonconfocal spheroidal gun, and a modified Heil gun were analyzed mathematically using the relaxation method. This method was also used to study the space-charge-limited potential distribution in spheroidal and paraboloidal diodes. A toroidal gun capable of high perveance but with resulting low convergence was studied using a gun tester. The pinhole-camera gun tester was utilized to study the paraboloidal-spheroidal gun, the nonconfocal spheroidal gun, the modified Heil gun, and a spherical cathode gun. Current density distributions in the beams, and in some instances transverse velocity distributions, were measured. In all cases, the measurements were made for a range of cold cathode-to anode spacings. These data are presented in detail and are intended as a guide in the design and utilization of these and similar electron guns. (Author)

Ohio State U. Research Foundation [Columbus].
LARGE-SIGNAL BEHAVIOR OF A DEGENERATE PARAMETRIC AMPLIFIER, by Y. P. Vaddiparty. Scientific rept. no. 3 on Contract AF 19(604)4060. Nov 59, 13p. 4 refs. AFCRC TN-60-161; AD-233 983.
Order from LC mi$2.40, ph$3.30 PB 146 606

Degenerate parametric amplifiers with the signal frequency at about half the pump frequency have been studied under strong saturating signals. Certain peculiarities of behavior including a shift in the frequency of maximum gain and sudden jumps in gain at certain frequencies in the pass band were observed. A semi-quantitative explanation in terms of the strong nonlinearity of the diode under saturating signals is provided. The results may be useful in providing information on the signal-handling capacity of an amplifier, particularly for modulated signals. (Author)

[Pacific] Missile [Range] Port Mugu, Calif.
KD2C-1 ZERO DRAG TELEMETERING ANTENNA DEVELOPMENT, by James C. Coe. 26 Nov 47, declassified 12 June 56, 22p. Technical rept. no. 23.
Order from LC mi$2.70, ph$4.80 PB 148 624

A Zero Drag telemetering antenna has been developed for the KD2C-1 in which the metal structure of the target drone is excited by a radio transmitter and feed line entirely contained inside the fuselage. This antenna was found to be decidedly superior to a quarter wave vertical antenna which used the metal structure of the target drone for a counterpoise as is common practice. The superiority was particularly marked with horizontally-polarized waves. In the course of the investigation, many antennas and feed lines in various combinations were installed and tested, and were found to be inferior to the internally-fed antennas as the representative patterns show. The Zero Drag antenna showed no effect upon the pattern of the control receiver. (Author)

Philco Corp., Lansdale, Pa.
NUCLEAR RADIATION RESISTANT POWER TRANSISTOR, RESEARCH AND DEVELOPMENT, by G. F. Watson. Quarterly progress rept. no. 2, 15 Aug-15 Nov 59, on Contract DA 36-039-sc-78307. [1959] 32p. R109-B; AD-231 899.
Order from LC mi$3.00, ph$6.30 PB 148 341

The calibration of the MIT nuclear reactor was verified. It was demonstrated that exposure of surface barrier transistors in core tube 3GV6 at a power level of 1 megawatt, for periods of 1.8 min and 18 min will provide accumulated dosages of 10^{13} and 10^{14} NVT, respectively. The haziness apparent at the bottom of etched pits was eliminated by the use of larger diameter jets. A cabinet-model precision plater was constructed and put into operation. Emitter electrodes 80 mils diam and collector electrodes 100 mils diam were plated with this system. Considerable progress was made in device assembly techniques. A brush plating technique was developed for gold plating only the top of the stem. Consistently good blank-to-tab soldering was obtained through the use of nickel tabs and a modified soldering fixture. Some difficulty has been experienced in soldering the collector electrode to the stem pedestal. A new stem mounting fixture is presently being evaluated. Un-mounted electrical samples were constructed. (Author)

Porter, H. K., Co., Inc., Prospect Park, Pa.
INDUSTRIAL PREPAREDNESS STUDY ON NON-NICKEL BEARING ALLOY BRAID WIRE, by F. J. Ferrari and W. J. Donnelly. Final engineering rept. for 23 June 57-31 Dec 58 on Contract DA 36-039-sc-72778. [1959] 15p. AD-218 990.
Order from LC mi$2.40, ph$3.30 PB 148 642

The study was conducted to obtain background in the drawing techniques of a substitute non-nickel-bearing 0.015-in.-diam. braid wire for 18-8 stainless steel used in the production of CX-1065/G (Spiral 4) cable and delivery of a pilot run production of this substitute wire. A trial lot of 100 lb of 1/4-in.-diam. rod was used to produce 0.015-in.-diam. braid wire according to the following practice: (1) pickling in HNO_3-HR (10-2 wt-%); (2) coating with Cowles and Lime; (3) cold reduction with HR Vaughn to 0.115-in. diameter in 5 holes; (4) cleaning with alkaline degrease; (5) annealing the strand in dissociated NH_3 atmosphere at 2000°F and 6 fpm; (6) pickling in HNO_3-HF; (7) coating with Cowles and Lime; (8) cold reduction with HR Vaughn to 0.051-in. diameter in 4 holes; (9) cleaning with alkaline degrease; (10) annealing the strand in dissociated NH_3 atmosphere at 2000°F and 10 fpm; (11) pickling in HNO_3-HF; (12) coating with Cowles and Lime; (13) cold reduction with HFV Vaughn to 0.031-in. diameter in 3 holes; and (14) cold reduction with 12 HF Vaughn to 0.015-in. diameter in 7 holes. Because of the lower corrosion resistance of the non-nickel bearing alloy substitute, the conversion practice employed in the production of 18-8 stainless steel braid wire must be modified. Bright annealing must be used in place of batch annealing and nonmetallic coating should be used to avoid exposure to severe acid clean cleaning.

Raytheon Co., Newton, Mass.
INVESTIGATION OF THE CORRELATION OF STANDARD DIODE EMISSION STUDY CONTRACT FINDINGS WITH PRODUCTION TYPE TUBES USING STANDARD PRODUCTION EQUIPMENT, by F. Hill, C. Bardsley and others. Scientific rept. no. 3, 16 June-15 Sep 59, on Contract AF 19(604)4095. 11 Nov 59, 43p. AFCRC TN-59-965; AD-233 494.
Order from LC mi$3.30, ph$7.80 PB 146 329

The Raytheon Company is conducting an investigation of the effect of the variable parameters of commercial exhaust procedure upon the reliability of emission capabilities of a commercial vacuum tube (6AH6). This is an attempt to correlate previous findings from exhaust studies with commercial methods of exhausting vacuum tubes. A total of 123 tests were conducted during this period on an improved exhaust machine. The improvement in pumping speed was attained on this exhaust urit by increasing the plumbing size between the exhaust stem of the vacuum tube and the vacuum pump. A comparison of initial electrical characteristics (0 hour readings) with the methods of exhaust processing show that the machine is capable of producing good tubes up to a speed of 1050 tubes/hour. A 25% reduction in current at exhaust lighting will only produce satisfactory tubes at 530 tubes/hour. A 25% increase in current at exhaust lighting produced heater burn-outs showing the limitations in heater design. Tests conducted at 900 tubes/hour without the use of oil diffusion pumps produced satisfactory tubes. (Author) (See also PB 143 399)

Ramo-Wooldridge Div., Canoga Park, Calif.
STUDY OF FAULT LOCATION AND PREDICTION TECHNIQUES LEADING TO PLANS FOR AUTOMATIC AND DYNAMIC TESTING OF MILITARY GROUND EQUIPMENT, PARTS III, IV, AND V. Final rept. on Contract AF 30(602)1997. 15 Feb 60, 205p. 50 refs. C62-9U37; RADC-TR-59-248B.
Order from LC mi$9.30, ph$31.80 PB 146 110

Part III. Details on Mechanization
Part IV. Recommendations
Part V. Illustration of Application of Automatic Fault Locator to a Representative Electronic System
(See also PB 146 109)

Raytheon Co., Newton, Mass.
INDUSTRIAL PREPAREDNESS STUDY ON TRANSISTORS AND AUTOMATIC MACHINERY FOR THEIR MANUFACTURE, by Frank M. Dukat and George Freeman. Step 1 Final rept. for 23 June 52-15 Oct 56 on Contract DA 36-039-sc-30237. [1956] 197p.
Order from LC mi$8.70, ph$30.30 PB 147 538

Machinery was developed for automatic and semiautomatic transistor manufacture. The transistor types for which this automation was accomplished were the low power germanium audio family, the 2N64 and 2N65. New surface treatments and packaging techniques were developed to accomplish and improve the product parameters and reliability. The automation program sponsored by this contract resulted in an overall increase in operator productivity of 4.6 to 1.

Raytheon Co., Waltham, Mass.
INVESTIGATION OF THE CORRELATION OF STANDARD DIODE EMISSION STUDY CONTRACT FINDINGS WITH PRODUCTION TYPE TUBES USING STANDARD PRODUCTION EQUIPMENT, by F. Hill, C. Bardsley and others. Scientific rept. no. 4, 16 Sep 59-15 Jan 60, on Contract AF 19(604)4095. 11 Mar 60, 36p. AFCRC-TN-60-184.
Order from LC mi$3.00, ph$6.30 PB 148 123

The effect is investigated of the variation in exhaust parameters upon the quality of emission on a 6AH6 type commercial vacuum tube. All tests conducted on the improved Sealex exhaust machine were burned on life for 500 hours and were evaluated for emission characteristics. Speed tests conducted from 530 to 1300 tubes per hour under standard exhaust conditions and with lighting variations show no difference in emission levels during life burning. All tests show the initial 24-hour slump. Extreme variations in exhaust lighting conditions (50% less lighting positions or a 25% reduction in lighting current) show gassy tubes at initial test. Tests conducted at 1200 tubes per hour show high initial gas scrap. A re-evaluation of tests conducted on an exhaust unit having poor pumping efficiency shows these tubes to have lower emission levels. An exploratory aging study points to the fact that this may be the reason for the previously-noted 24-hour slump. (Author) (See also PB 143 399)

Raytheon Co., Waltham, Mass.
STUDY OF PLATINOTRON DEVICES, by Gerry Perloff and W. C. Brown. Quarterly rept. no. no. 1, 1 Nov 58-1 Feb 59, on QKS-779, Contract DA 36-039-sc-78229. [1959] 56p. 3 refs. AD-227 039.
Order from LC mi$3.60, ph$9.30 PB 148 550

A study of platinotron devices was initiated. The research program is aimed at developing a microwave tube capable of producing a minimum of 100 w CW power and operating in the vicinity of 35 kmc with a minimum bandwidth of 10%. A design was laid out, major parts were ordered, and assembly of parts begun. Copper brazing of stainless steel parts was accomplished successfully. Some additional experiments on the adequacy of the liquid cooling system were made and it was determined that with stainless steel tubing with an inside diameter of .004", heat fluxes of 5 - 10 kw per sq cm could be successfully handled. It was determined that a flow of .25 gal per min of water could be obtained in an experimental header-vane assembly consisting of 21 stainless steel tubular vanes, each having 004"I. D. and each .261" long. If a bulk temperature rise of 50°C is assumed, a flow of .25 gal per min. represents more than 3 kw of anode dissipation. Results obtained to data indicate that this general approach to obtaining appreciable CW power in the millimeter region is quite feasible.

Rome Air Development Center, Griffiss AFB, N. Y.
IMPACT OF TRANSPORTATION ON ELECTRONIC EQUIPMENT, by John F. Carroll. Apr 60, 20p. 1 ref. RADC-TN-60-48.
Order from LC mi$2.40, ph$3.30 PB 147 641

The general impact of various modes of transportation on electronic equipment is considered in terms of amplitude, frequency, source impedance, and time. An analysis is made of a single degree of freedom, fixed end beam, using linear and non-linear response. It is concluded that no available measurements of environment are adequate to describe a source in quantitative terms, however, from observation of tests and field experiences, unrealistic failures in tests or deficiencies in test procedures can be determined. Proper design criteria can be derived only when test procedures become more realistic. (Author)

Schwinger, Julian, Cambridge, Mass.
INVESTIGATION OF HIGH FREQUENCY LIMITATIONS IN MILLIMETER WAVE GENERATORS, by Julian Schwinger. Semiannual rept. no. 1, Feb-Aug 59, on Contract DA 36-039-sc-78282. [1959] 35p. 5 refs. AD-231 593.
Order from LC mi$3.00, ph$6.30 PB 147 934

The theory developed dealing with the interaction between the electromagnetic field in a cavity resonator and a number of two-level molecules is generalized to include a gaussian spread in the molecular frequency. Using the formalism previously developed for a quantum-mechanical field in a lossy cavity, expressions are obtained by means of second-order perturbation theory for the expectation values of the field strength and field energy in the cavity and of the power loss by the molecules. It is shown that the parts of the field energy resulting from induced and spontaneous emission, respectively, initially increase as the square of the time and approach steady-state values after (different, in general) transient periods, each of which is determined by two time constants: cavity relaxation time and inverse molecular frequency spread. It is also shown that both the induced and spontaneous emission power radiated by the molecules increase initially linearly with the time and approach steady-state values after transient periods. (Author)

Shallcross Mfg. Co., Selma, N. C.
VIBRATOR TEST SET TS 747 ( )/U, by John L. McCotter, Jr. and John S. Shallcross. Final rept. for 8 Apr 57-18 Mar 59, on Contract DA 36-039-sc-73239. [1959] 83p. AD-228 801.
Order from LC mi$4.80, ph$13.80 PB 146 339

A vibrator test set was developed which is capable of testing vibrators in accordance with test procedures

recommended by vibrator manufactures. The instrument evaluates vibrators with the following tests: (1) the output voltage is checked from the power supply to determine if it is normal at a normal input voltage, (2) the operation of the vibrator is checked at high and low input voltages to determine that it will operate under both conditions, (3) provisions are made for testing the characteristics of a vibrator under load, (4) the operating frequency of the vibrator is measured at any instant by a built-in frequency measuring circuit, (5) buffering may be changed from primary to secondary or changed in value with switches on the panel, (6) a circuit breaker protects the vibrator power supply and it may also be used to determine the exact starting voltage of a vibrator, (7) a resistive load is provided for the secondary contacts of a self-rectifying type vibrator in order to observe the condition of these contacts, (8) a built-in electronic switch makes it possible to observe primary and secondary wave forms at the same time, and (9) the input voltage is provided in 3 continuously variable ranges, to provide a means for testing a vibrator above and below its normal operating voltage.

Smyth Research Associates, San Diego, Calif.
TROPOSPHERIC AND IONOSPHERIC RADAR REFRACTION EFFECTS, by L. J. Anderson, S. Weisbrod and others. Final rept. on Contract AF 30(602)1624. [1959] 114p. 4 refs. SRA-91; RADC-TR-59-84; AD-217 406.
Order from LC mi$6.00, ph$18.30 PB 147 149

This report describes simple methods for computing refraction effects, such as radar elevation angle and range errors, total ray bending and Faraday rotation, caused by the troposphere and the ionosphere. These methods are applied to radiosonde and ionogram data for Fairbanks, Thule and Leuchars, Scotland, to obtain the statistical distribution of refraction effects at these locations. The application of the methods to the computation of refraction effects at a given time and location is described in detail, and numerical examples are given. The statistical analysis shows that tropospheric refraction is greatest and most variable at Fairbanks. There is a seasonal trend at all stations, with maximum refraction at Thule and Fairbanks in winter, and in Scotland in summer. Ducting is weak at all stations; the lowest trapped radar frequency being 800 megacycles. (Author)

Sperry Piedmont Co., Charlottesville, Va.
SOUND WAVE RAY TRACER (MOD I). Final engineering rept. on Contract Nonr-790(00). Sep 58, 175p. Rept. no. 240-104.
Order from LC mi$8.10, ph$27.30 PB 146 104

The Sound Wave Ray Tracer MOD I, is a device which computes and plots a family of sound rays from the measurement of the velocity of sound through a medium as a function of depth. The equipment handles both surface and bottom reflections. The family of rays provides a complete picture of the sound field, and the density of the rays is an indication of the sound intensity. The equipment is built in and around a desk type cabinet. All operating controls are on the front of the unit. Electrical inputs are 115-volt, 60-cycle, single-phase, and 115-volt, 400-cycle, two-phase; the latter being supplied by a separate motor generator. These connections are made by means of connectors at the rear of the desk. All electronic units are housed in the pedestals of the desk assembly and all mechanical units are mounted on a base plate on the top of the desk.

Stanford Electronics Labs., Stanford U., Calif.
AN EXPERIMENTAL INVESTIGATION OF CROSSED FIELD INTERACTION, by T. Sato. Rept. on Contract AF 33(616)6207. 8 Feb 60, 85p. 32 refs. Technical rept. no. 385-5; AD-234 277.
Order from LC mi$4.80, ph$13.80 PB 147 245

An experimental study of the diocotron effect in a thin electron beam is presented. The diocotron effect is the amplification of microwave signals in an electron beam moving between parallel conducting plates, under crossed-field conditions. The diocotron effect was measured by means of an experimental tube. This tube has a variable-length drift section located between two magnetron-type beam coupling sections. The diocotron effect was directly measured by changing the drift section length and observing the change in the total gain of the tube. The diocotron effect was detected and measured as functions of the beam parameters and degree of modulation. Agreement with the small-signal theory of Heffner and Unotoro is good.

Stanford Research Inst., Menlo Park, Calif.
TECHNIQUES FOR PREVENTION AND REMOVAL OF ICE ON RADOMES, by I. G. Poppoff and R. C. Goettelman. Final rept. on Contract AF 30(602)1442]. 30 Apr 57, 70p. 17 refs. SRI Project SU-1614; RADC TR-57-123; AD-131 180.
Order from LC mi$3.90, ph$10.80 PB 146 374

Investigation of coatings that might reduce accretion and adhesion of ice showed that fabrics and other materials presently used for radomes already have the desired property of low ice adhesion. However, ice adhesion can be lessened further by the use of some silastics, silicones, and Teflon. Of the many "ice-phobic" coatings investigated, none was capable of reducing ice accretion more than 30% compared with radalon-neoprene. Several hypothetical systems were designed to illustrate the practicality and, in some instances, the cost of utilizing the techniques investigated in this study.

Syracuse U. Research Inst., N. Y.
STUDY OF SYSTEM RELIABILITY: ENTROPY OF A CONTINUOUS CHANNEL, by F. M. Reza. Final rept. on Contract AF 19(604)2452. Jan 60, 37p. 14 refs. Rept. no. EE-507-6001-F; AFCRC-TR-60-F.
Order from LC mi$3.00, ph$6.30 PB 148 093

The main object of this report is to outline some results for continuous channels similar to those discussed for discrete systems, principally, the entropy associated with a random variable assuming a continuum of values.

Tung-Sol Electric, Inc., Bloomfield, N. J.
UTILIZATION OF SELF-SUSTAINED ELECTRON EMISSION INVESTIGATION, by B. G. Firth and Warren C. Johnson. Quarterly rept. no. 3, 1 Apr-30 June 59, on Contract DA 36-039-sc-78081. [1959] 24p. AD-225 838.
Order from LC mi$2.70, ph$4.80 PB 147 989

The spot size obtainable in an MgO cathode-ray tube gun is better than originally thought possible. Evidence shows the high velocity electrons may be adequately focused, and the emission sustaining current reduced to the same order of magnitude as the beam current. Cathode improvement is required to achieve beam currents of 1 to 1.5 ma for picture tube applications. From tests made thus far, secondary emission preamplifier tubes appear to be within the realm of possibility. They can be used also to provide dynatron oscillations up to 15 mc and higher. Larger and somewhat better cooled cathodes are expected to make better audio amplifier tubes. Correction of cathode defects was achieved primarily by ultrasonic cleaning of cathode sleeves, cleaner hydrogen firing, better spray coating conditions, and the use of purer materials. (Author) (See also PB 147 988)

Vitro Labs., West Orange, N. J.
GENERAL USAGE ASSEMBLIES FOR NAVY ELECTRONIC EQUIPMENT. Quarterly progress rept. no. 9, 1 Feb-30 Apr 58, on Contract NObsr-72538. 22 May 58, 38p. KLX-10114.
Order from LC mi$3.00, ph$6.30 PB 149 288

The objectives of this work include the development of specifications for General Usage Assemblies, the purchase of representative types of sample assemblies from various manufacturers, construction of prototypes for evaluation of additional types, and the performance of similar work for transistorized General Usage Assemblies. Life tests of eleven types of General Usage Assemblies purchased from outside manufacturers are being conducted. Those units having the longest time on test have now passed 7000 hours. Additional failures occurring during the period of this report have been considered in arriving at revised estimates for mean time to failure for each of the types of assembly under test. Intensive investigation of the behavior of transistors under various conditions has led to the formulation of preliminary designs for three types of assemblies.

Westinghouse Research Labs., Pittsburgh, Pa.
ADVANCES IN SCREEN STRUCTURE AND DATA DISTRIBUTION FOR THE ELF DISPLAY SYSTEM, by E. A. Sack. Rept. on Contract NObsr-72782. 1 Mar 60, 34p. 5 refs. Scientific paper 410FF298-P1.
Order from LC mi$3.00, ph$6.30 PB 149 289

Each element of a typical ELF screen is a configuration of four capacitors, two diodes and a resistor. Microcircuit structures have been developed which achieve a display resolution of 256 elements per square inch. The switching matrix which distributes brightness control signals to the ELF elements is an integral part of the screen array. At present, multijunction silicon diode strips perform the switching function. Several one-inch-square model screens have been assembled. Larger arrays, eight inches wide by four inches high, are under construction. Screens with edge dimensions measured in feet appear to be feasible. The highlight brightness of experimental screens with 400 cps excitation is 10 foot-lamberts. Contrast ratios of between 50 and 100 to 1 are obtained with 200 volt control signals. Halftone uniformity is satisfactory. In one display system, brightness information is distributed at approximately one element per microsecond with a frame storage time of 5 seconds. Much longer image storage is possible with new switching techniques. (Author)

Ordnance, Missiles, and Satellite Vehicles

Air Force Missile Development Center, Holloman AFB, N. Mex.
WEAR, SOLID LUBRICATION, AND BEARING MATERIAL INVESTIGATION FOR HIGH-SPEED TRACK APPLICATIONS, by Milton R. Wolfson. Mar 60, 59p. 2 refs. AFMDC-TR-60-7.
Order from LC mi$3.60, ph$9.30 PB 148 204

High-speed wear and lubrication were investigated on 60 track tests made with the Stanford Research Institute test slipper. The variables were velocity, bearing material, nominal bearing pressure, and track condition. Wear rate of stainless steel increased with velocity (825 to 2,500 fps) while there was little or no apparent effect on molybdenum. Wear rate was reduced by several solid track coatings, most notably by metallic zinc and slaked lime. (Author)

Air Force Missile Test Center, Patrick AFB, Ala.
THE ACCURACY OF AMR INSTRUMENTATION. 5 May 60, 81p. 63 refs. RCA Quality Analysis TR no. 11; AFMTC-TR-60-13.
Order from LC mi$4.80, ph$13.80 PB 148 217

This report gives the best available estimates of the accuracy of RCA/MTP tracking instrumentation in use on the AMR range. These estimates are made on the basis of studies conducted over a considerable period of time. The report provides a definitive discussion of the character of the errors encountered and discusses methods used to determine estimates of errors. Comprehensive statements are made concerning the errors of measurement for the various instrumentation systems. Included also is a section on the determination of the accuracies of reduced data in position, velocity, and acceleration.

Air Force Missile Test Center, Patrick AFB, Fla.
A LEAST SQUARES PITCH AND YAW REDUCTION FOR NARROW ANGLE TRACKING CAMERAS, by George H. Rosenfield. Rept. on Missile Test Project Contract AF 08(606)3413. Jan 60, 57p. 7 refs. RCA Data Processing Technical rept. no. 57; AFMTC-TR-60-8.
Order from LC mi$3.60, ph$9.30 PB 148 314

A rigorous least squares adjustment is presented for computing the pitch and yaw elements of missile attitude, utilizing the measured V-angle of the missile body image vector with reference to the film co-

ordinate system. The solution directly computes absolute pitch and yaw using the missile images exposed on the photographic records from two or more photogrammetric tracking cameras. Camera orientations and measured V-angles only are required in the reduction together with an approximation of the missile attitude. An outline of the computational program and a numerical example is presented to facilitate programming for electronic computation. The procedure is applicable only to pitch and yaw reduction from long focal length, narrow-angle tracking cameras. It is based upon the assumptions that the line of sight from the camera to the missile coincides with the optical axis of the lens, and that the photographic plane is perpendicular to the line of sight. (Author)

American Inst. for Research [Pittsburgh, Pa.]
TECHNIQUES FOR HUMAN FACTORS EVALUATION OF PROTOTYPE SPECIAL WEAPONS AND ASSOCIATED EQUIPMENT, by James W. Shearer, Dan A. Peterson, and Edward B. Slebodnick. Rept. on Contract AF 29(601)513. Apr 59, 134p. AIR-259-59-FR-198; AFSWC-TR-59-14; AD-217 701.
Order from LC mi$6.90, ph$21.30 PB 146 599

The purpose of this study was to develop a method for systematic evaluation of human factors aspects of prototype special weapons equipment. Human factors inputs to system design have customarily been made in early planning stages and later on in operational testing stages. But until the present time there has been no set of techniques for coordinating human factors analyses of prototype equipment with engineering tests of prototype equipment. The techniques developed in this study are intended to fill this gap. Techniques developed include a guide to evaluation of preliminary manuals or instructions pamphlets, a guide to static evaluation of equipment, and an observational record form for use in functional try-outs of equipment. The guides assist the analyst in making recommendations for design of equipment and for content and format of instruction manuals. The observational record form is used in noting operational requirements for personnel, time, and training. It also is used for identifying personnel errors and error-likely situations. (Author)

Applied Psychological Services, Wayne, Pa.
TECHNIQUES FOR EVALUATING OPERATOR LOADING IN MAN-MACHINE SYSTEMS. APPLICATION OF A PREVIOUSLY DERIVED MODEL TO THE LAUNCHING OF AN AIR-TO-AIR MISSILE, by Arthur I. Siegel and J. Jay Wolf. Rept. on Contract Nonr-2492(00). June 59, 45p. 4 refs. AD-225 525.
Order from LC mi$3.30, ph$7.80 PB 146 684

Further evaluations were made of a previously derived model of the human operator in a man-machine system. The model was applied to the pilot's task of launching an air-to-air missile. Thirty-five computer runs, each representing 88 launchings by a given pilot type, were completed. For the average pilot ($F = 1.00$) a failure probability between 0.40 and 0.435 was indicated in the stress threshold range coincident with that previously derived for landing aboard a carrier. This range of failure probabilities does not coincide with the 0.186 value for failure probability given by outside criterion data for this launching task. Agreement with the 0.186 value was achieved by interpolation when $F = 0.91$, i.e., pilots who are 9% faster than average. The 9% discrepancy was believed to be a result, at least in part, of a fallible criterion. Over the two tasks the model (1) gave results which agreed in the main with information received from pilots; (2) was generally consistent; and (3) predicted reality reasonably well. It appears that the goal of prediction of the effectiveness of the human operator in man-machine systems has been achieved to some extent for single operator situations.

Army Ordnance Corps, Washington, D. C.
ACCEPTANCE INSPECTION EQUIPMENT DESIGN MANUAL FOR ORDNANCE MATERIEL. 1 Mar 56, 196p. ORD-M608-12.
Order from LC mi$8.70, ph$30.30 PB 146 182

The purpose of this manual is to prescribe the policies and procedures used in the preparation, interpretation and maintenance of all inspection equipment drawings. This manual also establishes and prescribes definite design data and practices applicable to inspection equipment.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
SATELLITE FREQUENCY MEASUREMENTS, by O. P. Layden and H. D. Tanzman. 1 Oct 59, 48p. USASRDL Technical rept. 2067; AD-229 155.
Order from LC mi$3.30, ph$7.80 PB 149 384

The investigation being carried out on the frequency observations of radio signals from the Russian and American satellites is discussed. Various plots of frequency versus time are given for the Russian and American satellites in orbit as well as take-off curves for all American satellites. The equipment used to obtain Doppler measurements is described and the frequency and time accuracy associated with the system is discussed. (Author)

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
VARIABILITY OF BALLISTIC METEOROLOGICAL PARAMETERS, by A. Arnold and R. Bellucci. 30 Aug 57, 114p. 16 refs. Technical memo. no. M-1913; AD-144 154.
Order from LC mi$6.00, ph$18.30 PB 148 119

Variability data from various sources have been examined. This examination led to equations describing variability of wind and of density. The magnitude of variability depends on geographic location, season of the year, and possibly other parameters. The data on wind velocity are more extensive, permitting a more thorough examination. For mid-latitudes and to moderate altitudes, for all seasons, and with an attempt made to remove instrumental error, the following equations were obtained: Time variation: r.m.s. velocity $= 4t^{0.5}$ where t is the time interval in hours (between the values of 1/2 and 12) and the velocity in miles per hour. Distance variation: r.m.s. velocity $= \frac{3}{2}s^{0.5}$ where s is the distance interval in

miles (between the values of 4 and 80). The above equations cover conventional winds. For ballistic winds the r.m.s. value should be reduced by 20 per cent.

Avco-Everett Research Lab., Mass.
AIR SCOOPING VEHICLE, by Felix Berner and Morton Camac. Rept. on Contract AF 04(647)278. Aug 59, 121p. 17 refs. Research rept. 76; AFBMD-TR-59-17.
Order from LC mi$6.30, ph$19.80 PB 147 213

A satellite vehicle is described which collects gases from the upper atmosphere and stores them in liquid form. Such a vehicle could serve as a filling station in space, furnishing liquid oxygen or air to other spacecraft. The vehicle represents an alternative to launching these liquids into orbit from the surface of the earth. The two methods are compared on an economic basis, and it is shown that the proposed vehicle permits substantial savings when operated beyond about one year. The feasibility of developing such a system for long-time operation is investigated. Several practical designs are discussed. (Author)

Avco-Everett Research Lab., Mass.
CONTROLLED RECOVERY OF NON-LIFTING SATELLITES, by R. W. Detra, F R. Riddell, and P. H. Rose. May 59, 20p. 9 refs. Research rept. 54.
Order from LC mi$2.40, ph$3.30 PB 147 202

This paper considers the problem of recovering, at a pre-selected site, satellites that are orbiting close to the earth (i.e., within a few hundred miles of the earth's surface). Considerations are limited to vehicles which accomplish re-entry into the atmosphere with drag devices. The discussion centers on two possible means of effecting controlled recovery of satellites.

Avco-Everett Research Lab., Mass.
THE DRAG BRAKE MANNED SATELLITE SYSTEM, by R. W. Detra, A. R. Kantrowitz and others. Aug 59, 26p. 19 refs. Research rept. 64; AD-227 524.
Order from LC mi$2.70, ph$4.80 PB 147 206

The manned satellite designs which have been most frequently proposed are extrapolations either of airplanes or of missile nose cones. A new approach is presented to the design of a manned satellite system. The central feature of this design is a variable area drag brake. For a given capsule and payload, the elements associated with attitude stabilization, recovery from orbit, re-entry, landing accuracy control and final landing of the system described comprise less than half the weight required for the same functions in presently envisioned retro-rocket systems. (Author)

Avco-Everett Research Lab., Mass.
A ROUGH ESTIMATE OF THE ATTENUATION OF TELEMETERING SIGNALS THROUGH THE IONIZED GAS ENVELOPE AROUND A TYPICAL RE-ENTRY MISSILE, by S. C. Lin. Rept. on Contract AF 04(645)18. Feb 56, 51p. 20 refs. Research rept. 74; AD-221 395.
Order from LC mi$3.60, ph$9.30 PB 147 212

A rough estimate was made on the attenuation of telemetering signals to be expected through the ionized gas layer surrounding a typical long range missile re-entering the earth's atmosphere at hypersonic speeds. The results indicate that in the frequency range used by the standard telemetering system, (e.g., the RDB system, $f \approx 200$ mc) it would be difficult to send any signal through the ionized gas throughout the critical part of the trajectory. If the electron-ion recombination rate turns out to be sufficiently rapid, microwave frequencies ($f \approx 3 \times 10^{10}$ cps.) will probably be satisfactory. Even if the electron-ion recombination rate is very slow, microwaves still seem to work at sufficiently high altitudes (above 150,000 ft or so) according to the present estimate. The low frequency end of the spectrum ($f \lesssim 1$ mc) can probably be utilized for transmission below the ionosphere. (Author)

Avco-[Everett] Research Lab., Mass.
A THEORY FOR THE ABLATION OF GLASSY MATERIALS, by Hans A. Bethe and Mac C. Adams. Rept. on Contract AF 04(645)18. Nov 58, 32p. 10 refs. Research rept. 38.
Order from LC mi$3.00, ph$6.30 PB 147 198

The ablation of glassy materials, when subjected to aerodynamic heating, is treated theoretically. The approximate equations are shown to be extremely accurate for determining the energy absorbed per unit mass of ablated material. For simplicity the analysis is restricted to the stagnation region of a blunted body and only steady state ablation is considered.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
BIOSATELLITE, DEVELOPMENT AND STUDY WITH; LETTER REPORT CONCERNING LIFE SUPPORT SYSTEM, by George H. Kydd and Peter Craig. Rept. MA-4 on BuMed Proj. MR 005.15-0002.16. 6 Jan 60, 14p. 1 ref. TED ADC AE 1412.2; NADC MA L6001; AD-231 598.
Order from LC mi$2.40, ph$3.30 PB 146 346

A closed system environmental chamber was designed and constructed for the purpose of studying animals under simulated capsule conditions for long periods of time. The chamber was considered to have worked well. Preliminary observations were made on the CO_2 scrubber, the circulating pump, temperature regulation, relative humidity, and the O supply system.

Ballistic Research Lab., Aberdeen Proving Ground, Md.
FREE FLIGHT RANGE TESTS OF A 10-CALIBER CONE CYLINDER, by Eugene D. Boyer, Apr 60, 33p. 15 refs. Memo. rept. no. 1258.
Order from LC mi$3.00, ph$6.30 PB 148 513

The aerodynamic properties of a ten-caliber cone cylinder are presented and analyzed. The Magnus data are definitely non-linear. It is shown that at

subsonic Mach number the non-linear Magnus moment should cause a limit motion. Finally the data are combined with results of a finned model program to yield the properties of the fins. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
MICROFLASH PHOTOGRAPHIC INSTRUMENTATION OF THE INTERIOR BALLISTICS LABORATORY, by E. L. Bonhage and H. G. McGuire. July 59, 24p. 4 refs. Memo. rept. no. 1216; AD-225 582.
Order from LC mi$2.70, ph$4.80 PB 148 459

Various high speed photographic instrumentation systems used to obtain well defined photographs of fast moving objects are described. Several experimental applications are explained briefly to illustrate the manner in which plate cameras or high speed continuous film cameras were used to record ballistic events illuminated with either one-shot flash sources or a single flash tube pulsed at a high rate. Experimental conditions dictating the choice of equipment, camera settings, film and developing procedures are discussed. Photographic results of each experiment, to show the quality of pictures obtained by these techniques are included. (Author)

Cryogenic Engineering Lab., National Bureau of Standards, Boulder, Colo.
CRYOGENIC MATERIALS DATA HANDBOOK. Quarterly rept. no. 5 on Contract AF 04(647)59-3. 15 June 60, 47p. 3 refs.
Order from OTS $1.25 PB 161 093-4

This issue includes graphs representing the data obtained during the period, an addition to the foreword, an accumulative index, and an addition to the tabular indexes. (See also PB 161 093-3)

Diamond Ordnance Fuze Labs., Washington, D. C.
PROCEDURE FOR DETERMINATION OF GAS EVOLVED BY THERMITE MIXTURES, by Robert E. McIntyre. 4 Feb 60, 24p. 3 refs. Technical rept. TR-702; AD-233 048.
Order from LC mi$2.70, ph$4.80 PB 146 752

A manometric procedure for the rapid determination of gases in pyrotechnic mixtures has been developed. The pressure readings are made using a strain gage pressure transducer, and readings taken at 135°C and at room temperature allow the determination of condensable and noncondensable gas as well as total gas. The sensitivity of the method is 0.01 ml of gas for the usual sample weighing 2 g, or 0.05 ml/g. About 30 min is required for a determination. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
PROPOSED VEHICLE FOR TEST AND RECOVERY OF GUIDED MISSILE FUZES, by D. A. Worcester and R. J. Gath. 5 Feb 60, 9p. Technical rept. TR-808; AD-233 018.
Order from LC mi$1.80, ph$1.80 PB 146 751

Determination of burst-height accuracy of guided missile fuzes is difficult because of the limited number of flights and, in some circumstances, the limitations of down-range field instrumentation which must cover a large impact area. A system has been designed to permit testing of complete fuzes by dropping in modified bombs with parachute recovery of the fuzes subsequent to function. This system permits simulation of approach conditions over an instrumented area, provides for accurate determination of burst height, and allows reuse of fuzes. Thus burst-height accuracy can be determined at low cost with a small number of fuzes. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
T320-TYPE (FIREFLY) FUZES, by Warren V. Moore. Summary 16 May 60, 22p. TR-822.
Order from LC mi$2.70, ph$4.80 PB 146 913

Mechanically operated 20- and 30-mm pyrotechnic-delay fuzes, capable of providing timed burst 1 sec and 2 sec after firing, have been designed and subjected to limited field testing. The 20-mm fuzes were designed specifically to check external ballistics of the M56 round when fired crosswind from an aircraft. The 30-mm fuzes are patterned after the 20-mm designs; the 1- and 2-sec delays in these fuzes differ only in burning rate and amount of delay powder. The basic design employs a spring-loaded firing pi.. that is held in place by two arming rods; a pyrotechnic delay and explosive train. The arming rods move out under centrifugal force, freeing the firing pin to start the delay. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF A PYROTECHNIC PHOTO RELAY FOR USE WITH A PHOTOCELL CONTACT FUZING SYSTEM, by Erling Bertrand. Mar 60, 21p. 8 refs. Technical rept. 2645; AD-235 187.
Order from LC mi$2.70, ph$4.80 PB 146 520

A pyrotechnic photo relay was designed to be used as part of a self-destructive device in a missile. As part of a photocell contact fuzing system, the relay will be initiated by the stab action of a firing pin in the fuze upon contact of a missile with the ground. Within less than 200 microseconds, the relay will emit sufficient light to activate a photocell located up to 7 feet from the relay. The configurations of the relay and the type of pyrotechnic compositions were established (NOL-130 primer mixture; 65/35 zirconium powder/potassium perchlorate flash composition) and the light output was brought under control; the firing time was investigated. When tested by dropping a weight on the firing pin, it was found that the functioning times were erratic and would occur as much as 700 microseconds after the weight struck the pin. An explosive ram was constructed to replace the drop weight. With this testing arrangement consistent firing times were obtained and the desired amount of light was produced within the required time interval. (Author)

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
WORK IN CONNECTION WITH IMPROVING PACKING FOR AERIAL DELIVERY OF FUZE, VT, (T178) M517, by J. M. Spilman. Final engineering rept. June 59, 15p. 3 refs. FR: 5-60; AD-230 645.
Order from LC mi$2.40, ph$3.30 PB 146 984

Three new designs and the standard design of packing supports were evaluated. During laboratory rough handling and simulated aerial delivery tests results showed that the design of polystyrene base and nose supports offered a greater degree of physical protection to the fuze. This was compared by observing battery failure which was found from previous tests to be the most sensitive part of the fuze to damage. In addition since the former design utilized two steel supports (basic design) and two cushions, savings in material and labor costs also resulted as did use of nonstrategic material by using the new design of polystyrene supports. For this reason it was recommended that the new design of packing supports be utilized. (Author)

Hermes Electronics Co., Cambridge, Mass.
PRECISION OF COMPENSATED TRACKING SYSTEMS, by Richard J. Davisson. Rept. on Contract AF 19(604)5905. 5 Nov 59, 147p. 136 refs. Rept. no. M-810; AFCRC-TR-59-356; AD-230 096.
Order from LC mi$7.20, ph$22.80 PB 147 343

Factors affecting the precision which can be achieved with various types of missile and satellite tracking systems are described. The "ranges" which are measured in pulse and doppler system are expressed as power series expansions in the reciprocal of the radio frequency employed. The terms of these series are discussed in relation to the tropospheric and ionospheric effects from which they arise, and methods for eliminating the principal refraction errors are described. It is shown that overall ranging errors can be reduced to the order of 30 ft or less by these techniques. Precision angle measurements are shown to be much more difficult to achieve. (Author)

Integrated Range Mission, White Sands Missile Range, N. Mex.
COORDINATE SYSTEMS AND TRANSFORMATIONS USED IN THE PREPARATION OF MISSILE DATA, by Marvin Mundt. Nov 58, 34p. 10 refs. Technical rept. 73; AD-207 497.
Order from LC mi$3.00, ph$6.30 PB 149 184

A report devoted to the discussion of the several coordinate systems and coordinate transformations used at the White Sands Missile Range. It has been designed to serve as a reference manual for those people who need to know about the coordinate systems and coordinate transformations used by the Data Reduction Division in the preparation of missile data. (Author)

Military Intelligence Service [Dept. of the Army] Washington, D. C.
HANDBOOK ON GUIDED MISSILES OF GERMANY AND JAPAN. 1 Feb 46, declassified 20 Feb 56, 211p. MID 461; ATI-742.
Order from LC mi$9.60, ph$33.30 PB 148 367

Naval Ordnance Lab., Corona, Calif.
FILTERING SAMPLED FUNCTIONS, by E. D. Fullenwider and B. I. McNamee. 12 July 56, rev. Apr 59, 44p. 12 refs. Technical memo. no. 64-104.
Order from LC mi$3.30, ph$7.80 PB 148 851

A method suitable for use with a digital computer in filtering any function of time sampled at a constant rate is described. Each point of the output is found by replacing the corresponding point of the input with a suitable linear combination of itself with adjacent values. The constants in the linear combination are those which minimize the rms magnitude of the difference between the desired and the actual frequency-response functions. This dependence of the output on both past and future values of input makes the filter more versatile than network filters. The spectral density of the input need not be known. Examples include a square filter, equivalents of network filters, and filters similar to network filters but without phase shift.

Naval Ordnance Lab., White Oak, Md.
A PIEZOELECTRIC FORCE GAGE FOR MEASURING DRAG ON TWO-DIMENSIONAL MODELS IN THE SHOCK TUBE, by William G. Luke and Luther W. Slifer. 1 Apr 59, 61p. 4 refs. NAVORD rept. 6211; DASA-1170.
Order from OTS $1.75 PB 161 872

The design, development, testing, and final evaluation of a piezoelectric force gage for measuring drag forces in a shock tube are described. The gage is a one-inch cylinder of square cross section which, when mounted, extends across the entire width of the shock tube. It has a central test section which is free to respond to applied forces while the end sections are rigidly mounted to the shock tube walls. In this way, registry of end and wall effects is minimized so that the gage configuration may be considered two-dimensional. The sensing element of the gage is a one-half-inch-diameter, four-pile, plastic-bonded, tourmaline crystal stack which is readily adaptable to other gage configurations. The plastic-bonded element is superior in ruggedness to conventional, solder-bonded elements and has a comparable sensitivity of 24 micromicrocoulombs per pound. It is capable of withstanding forces up to 30 pounds. This is adequate for shock pressures up to 10 psi but breakage of the crystals is expected to occur frequently when larger forces are applied. Inaccuracies of the gage are estimated to be less than 15 per cent under any of the test conditions for which it is intended. The errors result primarily from the sensitivity of the gage to temperature and from record-reading inaccuracies due to noise level. (Author)

Naval Ordnance Lab., White Oak, Md.
PISTON TYPE STRAIN GAGES, by V. C. D. Dawson. 13 Jan 59, 15p. 5 refs. Ballistics research rept. 11; NAVORD rept. 6251; AD-220 458.
Order from LC mi$2.40, ph$3.30 PB 148 452

For the past several years piston type strain gages have been used at the Naval Ordnance Laboratory's ballistic range facilities to record pressures. The theory used to predict the frequency response, sensitivity and pressure limit of such gages is presented. (Author)

Naval Ordnance Test Station, China Lake, Calif.
THE DEVELOPMENT OF THE SQUIB MK 1 FOR USE IN NAVY ROCKET IGNITERS, by R. L. Smith. 6 Apr 56, 30p. 6 refs. NOTS 1384; NAVORD rept. 5039.
Order from LC mi$2.70, ph$4.80 PB 149 270

The Squib Mk 1 was developed in response to the need in Naval ordnance for a high-quality squib to initiate small metal-cased igniters. The first fully specified, non-proprietary Navy squib, the Squib Mk 1 overcomes the deficiencies of earlier squibs in reliability, safety, and quality control. The results of proof testing in 2.75-in. folding-fin aircraft rocket igniters and motors were entirely satisfactory. Of more than 12,000,000 squibs produced, none have been rejected. (Author)

Naval Ordnance Test Station, China Lake, Calif.
HANDBOOK ON THE EFFECTIVENESS OF CLUSTER WEAPONS AGAINST UNITARY TARGETS, by Eldon L. Dunn. 12 Jan 60, 177p. 3 refs. NOTS TP-2382; NAVORD rept. 7019; AD-234 857.
Order from LC mi$8.10, ph$27.30 PB 146 990

This report contains the results of a parametric study on the effectiveness of cluster weapons against unitary targets, where a unitary target is a target such as a tank or ship which may be regarded as a unit for purposes of tactical warfare. The effects of number of bomblets, delivery error, ammunition dispersion, target length and width, warhead effectiveness and inclination of trajectory are considered. The results of the study are presented in handbook form so that one may quickly determine the effectiveness of any proposed cluster weapon, once specific values have been assigned to the above parameters. (Author)

Naval Ordnance Test Station, China Lake, Calif.
LOCKSEAL JOINT FOR ROCKET COMPONENTS, by Sydney R. Crockett. 11 Oct 57, 56p. 2 refs. NOTS-1492; NAVORD rept. 5275; AD-150 474.
Order from LC mi$3.60, ph$9.30 PB 146 529

In response to the need for an improved means of uniting the components of a rocket, the Lockseal Joint has been conceived and develope It locks and seals one component to another by forcing metal from the wall of one into a rubber-lined, circumferential groove in the surface of the other. In work to date it has been applied to 1- to 3-in., soft-steel and hardened-steel motor tubes, and to 1- to 5-in., soft-aluminum and hardened-aluminum tubes--the walls of both steel and aluminum tubes being of varying thicknesses. Numerous tests have demonstrated its superiority in many respects, including strength, axial alignment, and producibility, to joints now commonly used in rocket design. (Author)

Naval Ordnance Test Station, China Lake, Calif.
A METHOD OF IGNITING SMALL PROPELLANT GRAINS IN A LARGE COMBUSTION CHAMBER, by Carl D. Runge. 28 Oct 59, 18p. NOTS TP-2355; NAVORD rept. 6612; AD-234 839.
Order from LC mi$2.40, ph$3.30 PB 146 985

Several methods of igniting a short ammonium nitrate grain housed in a long grain chamber were explored. The requirement for this use occurs in short-duration torpedo tests in which grains of considerably less than full length are needed. The result of the experimental investigation was an effective pyrotechnic ignition system for this situation. The ignition method which proved most successful used an assembly of ammonium perchlorate propellant and boron potassium nitrate pellets on the ammonium nitrate grain base.

Naval Ordnance Test Station, China Lake, Calif.
A PHOTOMETRIC SYSTEM FOR MEASURING INTENSITY AND DURATION OF PYROTECHNIC SIGNALS: DESCRIPTION AND USE, by R. E. Lawrence. 17 Sep 58, 31p. NOTS 2105; NAVORD rept. 6408; AD-207 684.
Order from LC mi$3.00, ph$6.30 PB 146 991

A description is given of the photometric instrumentation developed for the measurement of the intensity, duration, and inherent delay of flash signals used for inflight evaluation of missile fuzes. The delay time and the duration are typically measured to the nearest 0.1 millisec. The light intensity is normally read to an accuracy of about 5%. This report serves as an operational manual for the technicians who use the equipment and as a source of information for others who may wish to duplicate the equipment and methods. (Author)

Naval Ordnance Test Station, China Lake, Calif.
PINHOLE CAMERA DETERMINES SPATIAL POSITION, ORIENTATION, OR DYNAMIC SURFACE PRESSURE OF MISSILE, by D. B. Clark and W. H. Allan. 14 Apr 59, 22p. NOTS TP 2217; NAVORD rept. 6526.
Order from LC mi$2.70, ph$4.80 PB 146 525

A new technique was devised for measuring the roll, yaw, and pitch orientation of a missile. These measurements may be made while the missile is accelerating in the launching tube or while the missile is in free flight. The technique uses a pinhole camera located in the nose of the missile and electronic flash lamps for reference lights. The camera photographs the pulsating reference lights that are located downrange--one on each side of the trajectory line.

Naval Ordnance Test Station, China Lake, Calif.
ROCKET THRUST VECTORING BY USE OF SECONDARY INJECTION; A NEW METHOD OF RECLAIMING ENCAPSULATED ELECTRONIC COMPONENTS; TEMPERATURE-PRESSURE PROBE FOR HIGH-TEMPERATURE GAS STREAM, by L. T. Bankston, E. H. Bartel and others. 3 June 60, 3p. Technical Brief 1; NOTS TP-2449.
Order from LC mi$1.80, ph$1.80 PB 147 910

Naval Ordnance Test Station, China Lake, Calif.
THE WATER EXIT OF A MISSILE RELEASED BELOW THE SURFACE OF THE OCEAN, by Warner Goldsmith. Rept. for June-Aug 57. 3 Aug 57, 27p. NOTS 1838; NAVORD rept. 5622; AD-160 387.
Order from LC mi$2.70, ph$4.80 PB 146 095

Equations of motion are developed describing the behavior of a missile at the water-air interface of an ocean after release of the missile from a submerged position. The missile is modeled as a rigid right-circular cylinder and is assumed to execute plane motion under the action of gravity, forces produced by surface waves, and a current of constant velocity. The initial conditions for the present problem must be derived numerically as the terminal values for the subsurface motion of the missile which has been described in a previous report. A complete analysis of the surface emergence of the missile requires the numerical solution of the differential equations on an automatic computer. (Author)

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
A METHOD FOR PREDICTING THE LIFETIME OF A NEAR SATELLITE, by R. Earl Good. Master's thesis. Rept. on Contract AF 19(604)5894. Jan 60, 63p. 21 refs. Technical rept. 418; AFCRC-TN-60-287.
Order from LC mi$3.90, ph$10.80 PB 148 530

The behavior of satellite orbits under the perturbing effect of atmospheric drag is studied in order to determine the lifetime of a satellite. The wide extremes in drag coefficient, velocity, and density that a satellite experiences during one revolution is studied for possible methods of removing uncertainties in the lifetime predictions. By dividing the satellite lifetime into three phases - circularization, spiral decay, and terminal - approximate methods can be developed to estimate the satellite lifetime in each phase. The method developed is based on the law of conservation of energy. It considers a differential loss in energy per revolution through the drag; and then by integrating for N number of revolutions, the total change in the ellipse shape is determined per revolution. The lifetime of the satellite is then the sum of the revolutions in each phase. (Author)

Office of Ordnance Research, Durham, N. C.
TRANSACTIONS OF THE CONFERENCE OF ARSENAL MATHEMATICIANS [NO. 5] HELD AT ROCK ISLAND ARSENAL 3-4 JUNE 1959. May 60, 119p. 10 refs. OORR 60-1. AD-237 914.
Order from LC mi$6.00, ph$18.30 PB 148 218

Contents:
Launcher dynamics
An approach to dimensional analysis applied to the dynamics of a rocket launcher under aerodynamic load
Some results of an a^3 theory applied to the buckling of a shallow spherical shell
Application of the Kronecker product in multivariate interpolation
On the theory and application of finite operators
Mathematics in the theory of information retrieval
Solution of the Euler angle transformation equations
The Jet Propulsion Laboratory method for tracking a lunar probe
A confidence interval for Monte Carlo proceaures
Earth satellite orbit determination theory
(See also PB 144 052)

Oklahoma State U. Research Foundation, Stillwater.
RESEARCH DIRECTED TOWARD THE DESIGN, DEVELOPMENT, AND CONSTRUCTION OF METEORITIC MICROPHONE DETECTORS OF VARIOUS SENSITIVITIES FOR USE IN SATELLITES, by H. E. Harrington. Scientific rept. no. 1 on Contract AF 19(604)5715. 15 Jan 60, 34p. AFCRC TN-60-229; AD-233 737.
Order from LC mi$3.00, ph$6.30 PB 146 319

An electronic system designed for the express purpose of exploiting the data-gathering potential of a specific vehicle in obtaining information regarding the influx of micrometeor material was developed. An acoustic sensing technique is employed, whereby the particulate matter to be detected activates a supersonic microphone device. The resultant electrical signal is amplified to a suitable level, graded as to magnitude, and stored internally by electronic means for subsequent recording and/or telemetering to ground receiving stations by the system inherently available within the chosen vehicle. A brief historical background of the development of the technique is presented, together with details of the specific system evolved for this application. Various design features which are peculiar to this application are presented and discussed. The prototype equipment which resulted from the development program was subjected to a testing program to verify its suitability for the anticipated use, and several sets are currently under construction. (Author)

[Pacific] Missile [Range] Port Mugu, Calif.
INVESTIGATION OF SINGLE JATO BOOSTER LAUNCHINGS OF LTV-N-2 TYPE MISSILE, by Willy A. Fiedler and Robert Lusser. Rept. on Proj. TED MTC PA-501.1. 20 Sep 49, declassified. 37p. GSR-11; Technical rept. no. 60.
Order from LC mi$3.00, ph$6.30 PB 148 631

Launching configurations for LTV-N-2 type missiles using one JATO, 2KS-33,000, with either straight or canted nozzle are described. The advantages, possibilities, and special problems of each configuration are discussed, using the LTV-N-2 missile as an example. Two types of launchers for zero- and short-length launching are described. New methods of athwartship firing and jettisoning of the missile in event of emergency are discussed. Storage of two LTV-N-2 missiles in the existing submarine hangar is found practicable. Combined methods of c. g. determination and JATO thrust alignment are described. Studies and calculations indicate that complete reliability can be attained with a single JATO booster in zero- and short-length launchings. (Author)

[Pacific] Missile [Range] Port Mugu, Calif.
PTV-N-2 (GORGON IV). Final rept. on Proj. TED MTC PA-503. 14 Dec 48, declassified 12 June 56, 26p. Technical rept. no. 40.
Order from LC mi$2.70, ph$4.80 PB 148 626

This project was established to evaluate the C-20-.85C ramjet power plant as a propulsion unit, utilizing the PTV-N-2 (GORGON IV) as a vehicle. The first five free-flight tests were conducted for the primary purpose of aerodynamic evaluation of the test vehicle. Sufficient data were accumulated during

these tests to make this evaluation. As a flight-test vehicle, PTV-N-2 possessed a high degree of aerodynamic stability in both powered and unpowered flight, but flight durations were limited by equipment failures. Two vehicles were expended for a later ramjet evaluation phase. The performance of the C-20-.85C ramjet power plant revealed that difficulties would be encountered in securing reliable operation at the designed Mach number of 0.85. The next phase of the PTV-N-2 flight test program was devoted to investigating the suitability of five vehicles as target P/A.

Picatinny Arsenal, Dover, N. J.
PYROTECHNIC SPOTTING DEVICE FOR THE HONEST JOHN ROCKET SYSTEM, by Ralph B. Wright. July 60, 31p. Technical rept. 2691.
Order from LC mi$3.00, ph$6.30 PB 146 877

This report describes the development of a pyrotechnic spotting device for the Honest John rocket. To meet stringeht requirements as to time of functioning, resistance to surface heating, interchangeability of units used to signify different events, and resistance to both vibration and acceleration stresses, a literature study of initiators and compositions, as well as a series of local laboratory experiments and static tests, was necessary before the first complete design could be attempted. As work progressed, requirements were changed, necessitating modifications of existing designs or complete redesigning of the device. Thus, several spotting device designs, designated Types 1, 2, 3, 10, and 13, were completed specifically for the Honest John rocket. The Type 13 design takes into consideration all mandatory requirements for an Honest John rocket spotting device made up to the date of this report. Types 2, 3, 10, and 13 have all been used successfully in Honest John system flights. This work indicated that development of flash charges of various specific light intensities and durations, capable of matching various light, camera, and film conditions, would be useful during future missile test flights employing spotting devices. (Author)

Picatinny Arsenal, Dover, N. J.
USE OF CLOSED BOMB TEST METHODS FOR ASSESSING 81 mm MORTAR PROPELLANT, by Lester Shulman and Louis Bottei. July 60, 11p. 4 refs. Technical rept. 2693.
Order from LC mi$2.40, ph$3.30 PB 147 852

The results obtained from 320 closed bomb firings and 280 proof firings of test samples representing 14 production lots of M5 increment propellant for the 81 mm mortar indicate a high degree of correlation, as shown by the statistical "H" test. On the basis of these results, equations relating flight velocities and mortar tube pressures to closed bomb parameters are derived. With these equations, velocities and pressures for the 81 mm mortar can be predicted within $\pm$2.3% and $\pm$4.9%, respectively. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
EXPERIMENTAL TEMPERATURE DISTRIBUTION IN A HEMISPHERICAL NOSE CONE IN HYPERSONIC FLOW, by S. V. Nardo, John L. Boccio, and others. Rept. on Contract Nonr-839(23). June 59, 56p. 3 refs. PIBAL rept. no. 494; AD-218 655.
Order from LC mi$3.60, ph$9.30 PB 146 581

Results are presented of tests on a hemispherical nose cone in the hypersonic tunnel. The test conditions with respect to Mach number and Reynold's number correspond to Mach numbers in the range of 15 to 20 at altitudes of 85,000 ft and higher. The stagnation temperature was varied from 850° F to 14000°F. Aerodynamic and thermal load data are given in the form of pressures along a meridian of the model and temperature-time histories at various points on the model. Future research will involve the analysis of these data in order to evaluate heat transfer coefficients and the thermal and mechanical stresses within the body. The hemispherical nose cone is made of Type 304 stainless steel, has an outer diameter of 7-3/4 in. and is one in. thick. Instrumentation consists of 13 pressure taps and 40 thermocouples. (Author)

Rock Island Lab., Ill.
THE EFFECT OF VOLATILE CORROSION INHIBITORS ON MIL-B-131 BARRIER MATERIALS, by E. S. Burke. 2 Feb 60, 21p. 10 refs. Rept. no. 60-294; AD-234 721L.
Order from LC mi$2.70, ph$4.80 PB 147 338

MIL-B-131 barrier materials with polyvinyl chloride, polyethylene and metallized polyethylene-polyester heat sealing films, respectively, and unsupported films of these plastics were placed in contact with paper impregnated with dicyclohexyl ammonium nitrite; a mixture of urea, sodium nitrite and monoethanolamine benzoate; dicyclohexylamine caprylate; and an amine carboxylate and exposed to temperature cycling for various periods of time. The effect of these conditions on the water resistance of the seal, moisture vapor transmission rate, delamination of the plastic film and sealability of the barrier material was measured as well as the effect of this exposure on the tensile and elongation properties of the unsupported plastic films.

Rock Island Arsenal Lab., Ill.
WET STRENGTH IN ORDNANCE PACKAGING, by W. F. Garland. 21 Dec 59, 22p. 20 refs. Rept. no. 59-3219; AD-233 868L.
Order from LC mi$2.70, ph$4.80 PB 147 221

This report covers the evaluation of thirteen commercially available wet strength papers of the kraft type, i.e., as used in several Military packaging specifications. Wet strength treatments of these papers included: synthetic rubber latices, formaldehyde resins, fluorochemicals and two treatments not stated. The wet tensile strength and percent wet strength of all materials was considerably greater than that of the two control materials. As a group, the synthetic rubber treated papers showed a higher percent wet strength than the other papers tested. Only one wet strength treated paper was effectively fungus resistant. (Author)

Rome U. (Italy).
ANISOTROPIC COMPOSITE THERMAL STRUCTURES FOR HYPERSONIC FLIGHT, by Luigi Broglio. Technical note no. 1 on Contract AF 61(052)198. Feb 59, 49p. 7 refs. SIARgraph no. 52; AFOSR-TN-59-1015; AD-230 231.
Order from LC mi$3.30, ph$7.80 PB 146 707

The solution is given for the instantaneous source of heat located at a generic point of an anisotropic heterogeneous composite body of whatever shape. The solution satisfies both the differential equation of the heat conduction and the boundary conditions of the specific body. Thus, by using appropriate space integrals of such solution and by leaving all kinds of nonlinearities (such as variation of thermal properties, radiation and so on) to the final timewise integration, a very general solution is found. The solution is introduced for the thermal shock generated by an instantaneous unit timewise temperature step at a generic point of a body of whatever shape. The solution satisfies the differential equations of the dynamic thermal motion and the boundary conditions of the specific body. Here again the most general solution is immediately written as an appropriate space and time integral of the unit solution. By combining the results, the thermal motion generated by an instantaneous heat source located at a generic point is obtained. (Author)

Springfield Armory, Mass.
NONDESTRUCTIVE INSPECTION OF BRAZED CLEVIS ON 7.62mm M60 MACHINE GUN OPERATING ROD GUIDE ASSEMBLY, by R. D. Korytoski and E. H. Abbe. 28 Dec 59, 17p. 3 refs. SA-TR19-1504. AD-237 235.
Order from LC mi$2.40, ph$3.30 PB 147 914

An investigation was made in order to develop a nondestructive test method for the evaluation of brazed joints on the M60 guide assembly operating rod. The ultrasonic resonance method provided a nondestructive test means to evaluate the soundness of brazed areas. Completely brazed areas produced several resonance indications with thickness approximating 0.130 inch. A poorly brazed joint shows a single resonance indication with thickness approximately 0.050 inch. Ultrasonic pulse echo method could not be be practically applied. The ultrasonic resonance method proved most feasible and was used in the development of inspection procedures. (Author)

Watertown Arsenal Labs., Mass.
HYDROSTATIC TESTING OF COLD EXTRUDED 155mm HE SHELL, M107, by C. A. Riddle and E. J. Lemay. Jan 60, 45p. Technical rept. no. WAL TR-763.71/1; AD-233 958.
Order from LC mi$3.30, ph$7.80 PB 147 234

Cold extruded 155MM HE Shell, M107, from six different lots containing exterior surface defects peculiar to the manufacturing process, were internally loaded to destruction with hydrostatic pressure. Surface defects were detectedy by "Magnafluxing" and examination with a crack depth indicator. Strain measurements were recorded. The test results demonstrate that the type of surface defects encountered do not contribute to an increase in the amount of strain in defective surface areas when compared with nondefective areas. (Author)

Watertown Arsenal Labs., Mass.
METALLURGICAL EXAMINATION OF 155mm T387 HE SHELL, by C. A. Riddle. Feb 60, 14p. Technical rept. WAL TR 763.6/1; AD-234 564.
Order from LC mi$2.40, ph$3.30 PB 147 278

Mechanical and metallurgical properties of four 155MM Shell, HE, T387 were determined. The variation of properties throughout the shell length are noted. Improperly seated rotating bands are considered to be a serious defect in manufacture. (Author)

Watertown Arsenal Labs., Mass.
THE RIFLING AND ROTATING BAND DESIGN HANDBOOK. SUPPLEMENT. SECTION 3.2. DETERMINATION OF BAND PRESSURE EXPERIMENTALLY, by Francis I. Baratta and John Campo. Mar 60, 64p. 3 refs. Technical rept. no. WAL TR 760/410-2; AD-234 995.
Order from LC mi$3.90, ph$10.80 PB 147 277

This report is to be incorporated in the "Rifling and Rotating Band Design Handbook," WAL No. 760/410(c). Specifically, some of the results of the "Thick Walled Cylinder Handbook," WAL no. 893/172 (PB 119 941), have been extended and presented here in a different manner so that, by their use, both band pressure as a function of travel as well as band pressure at the maximum radial loading may be readily determined experimentally. Illustrative problems are included to better acquaint both band and gun tube designers with techniques involved in experimental determination of band pressure.

Watervliet Arsenal, N. Y.
ANALYTIC DEVELOPMENT OF DESIRABLE STRESS DISTRIBUTION CHARACTERISTICS IN SEALING RINGS LEADING TO RECOMMENDATION OF RING NO. 5 FOR APPLICATION TO CLOSED BREECH LAUNCHERS, by M. A. Sadowsky. Mar 60, 98p. Technical rept. WVT RR-6006.
Order from LC mi$5.40, ph$15.30 PB 146 215

Laboratory testing of closed breech sealing rings Nos. 1 and 4 and the mathematical analysis of those rings showed that they are prone to elliptic buckling and plastic flow due to stress concentration at the lips. Ring No. 5 was then designed on the basis of mathematical shell theory. It is believed that it will be as nearly free from those faults as possible. It is suggested that Ring No. 5 be produced and evaluated experimentally. (Author)

Sanitation and Safety Engineering

California Inst. of Tech., Pasadena.
STUDY OF THE PROPERTIES OF AEROSOLS, WITH PARTICULAR REFERENCE TO THE NATURE OF THE AIR-PARTICLE INTERFACE, by Alexander Goetz. Final rept. for 1 Jan-31 Aug 58 on Contract SAph-69557. 1958, 104p. 11 refs. Robert A. Taft Sanitary Engineering Center Technical rept. A58-10.
Order from LC mi$5.70, ph$16.80 PB 149 189

Contents:
Part A. The aerosol spectrometer and its application
Part B. The bacteriological irritation analogue (BIA) test

Naval Civil Engineering Lab., Port Hueneme, Calif.
ABC DECONTAMINATION EQUIPMENT FOR PERSONNEL IN THE ARCTIC, by W. R. Nehlsen. Final rept. 8 Mar 60, 17p. 4 refs. NCEL Rept. 072; AD-234 875.
Order from LC mi$2.40, ph$3.30 PB 146 969

A 60 man per hour portable shower unit was designed for decontamination of large numbers of personnel in arctic climates. A shower waste water treatment and recirculation system was included to minimize the effects of critical water shortages expected under arctic conditions. Tests on the shower waste recirculation system showed that satisfactory results could be obtained on atomic and biological agents, but the allowable time interval before starting chemical agent decontamination proved to be so brief that no mass decontamination method could be considered effective. Because of the inherent dangers of the recirculating system, an individual washing kit was devised as an alternative to the shower unit. The individual washing kit is safer and more economical for atomic and biological decontamination, but neither system is suitable for chemical agent decontamination. (Author)

Ship Building

David Taylor Model Basin, Washington, D. C.
COMPARATIVE SEAKEEPING TESTS AT THE DAVID TAYLOR MODEL BASIN, THE NETHERLANDS SHIP MODEL BASIN AND THE ADMIRALTY EXPERIMENT WORKS, by George P. Stefun. May 60, 38p. 13 refs. Rept. 1309.
Order from LC mi$3.00, ph$6.30 PB 148 653

Comparative results are presented of seakeeping tests on a model in waves run at the David Taylor Model Basin (TMB), the Netherlands Ship Model Basin (NSMB), and the Admiralty Experiment Works (AEW). A brief description is given of the test methods used by the three tanks in connection with the test program initiated by the International Towing Tank Conference (ITTC). The results of the wave tests are compared with respect to resistance, shaft rpm, heave amplitude, pitch amplitude, and phase-angle measurement. The comparisons indicate that fair agreement among the three tanks exists for most of the test conditions, but somewhat large discrepancies exist for conditions of low model speeds and for large wave amplitudes. The reasons for discrepancies are discussed together with recommendations for improved correlations for future seakeeping test results. (Author)

Davidson Lab., Stevens Inst. of Tech., Hoboken, N. J.
EFFECT OF APPENDAGE AND HULL FORM ON HYDRODYNAMIC COEFFICIENTS OF SURFACE SHIPS, by Stavros Tsakonas. Rept. on Contract Nonr-263(18). July 59, 66p. 11 refs. Rept. no. 740; AD-220 007.
Order from LC mi$3.90, ph$10.80 PB 147 083

Tests were made to determine the hydrodynamic coefficients in the yaw plane of EET Model 842 (of the Taylor Standard Series) with skegs of varying size, shape and position. Similar experiments were conducted with flat plates having the same profile area and geometry as the various configurations. The static and damping hydrodynamic coefficients were determined for various angles of attack by means of straight-course experiments and by interpolation of rotating-arm data. Comparison of the straight-course results with those derived by linear interpolation of the rotating-arm data show excellent agreement. Investigation of various flat plates reveals a similarity between the hydrodynamic characteristics of a model and those of a corresponding plate. An attempt to study the usefulness of the flatplate coefficients in regard to determining the stability indices for a ship model of the same profile area is included. (Author)

George Washington U., Washington, D. C.
AN APPROACH TO THE PROBLEM OF ALLOWANCE LIST EVALUATION, by Sheldon Haber. Rept. on Contract Nonr-761(05). 20 Aug 59, 32p. 7 refs. Serial T-108/59; AD-226 119.
Order from LC mi$3.00, ph$6.30 PB 148 157

The essential feature of the allowance list problem is the specification, in advance, of the range and quantity of commodities to be stocked on vessels to meet varying demands under conditions of uncertainty, where the supply of commodities is subject to a space restraint as well as other possible restraints. An attempt is made to explore the process of evaluating alternative allowance lists, the commodities of which can be ranked only ordinally. The assumption was that alternative allowance lists are available and the parts with high and low military worth can be distinguished. Criteria of allowance list efficiency used by other investigations are organized into 2 groups: range measures that take into account the number of different parts demanded but not stocked, and depth measures that indicate the extent to which stocked parts are stocked in insufficient quantities. Several measures are proposed to supplement the conventional range and depth measures. These were designed to determine the range of exchange rates between high- and low-worth parts for which one allowance list is preferable to another.

George Washington U., Washington, D. C.
AN EXAMINATION OF CRUISER USAGE DATA, PART 2, by Mina Haskind Gourary. Rept. on Logistics Research Project, Contract Nonr-761(05). 1 Sep 59, 12p. 3 refs. Serial T-110/59; AD-226 364.
Order from LC mi$2.40, ph$3.30 PB 148 586

An examination is made of cruiser electronic parts usage data (Cognizance-N material). Tabulations are presented of the actual demand for electronics materials. These tables provide information on the number of transactions per quarter; on the frequency with which items are demanded during a stated period of time; on the total quantity used during a stated time period of a given item; and on the distribution of usage among the ship itself, shipyards, tenders, and other activities.

George Washington U., Washington, D. C.
SIMULATIONS OF ALTERNATIVE ALLOWANCE LIST POLICIES, by Henry Solomon and Marvin Denicoff. Rept. on Logistics Research Project, Contract Nonr 761(05). 25 May 59, 36p. 4 refs. Serial T-102/59; AD-216 826.
Order from LC mi$3.00, ph$6.30 PB 146 584

A simulation is described to permit an evaluation of alternative policies for constructing allowance lists for naval vessels. The research program, the allowance list test program (ALTP), aims to increase the supply endurance and self-sufficiency of combatant ships through the medium of improved allowance lists. The following factors are considered: endurance loading, the period of support, criteria for selecting the range and depth of insurance items, and the storage limitation of the ships.

Naval Technical Mission in Europe.
GERMAN SUBMARINE DESIGN, 1935-1945, by W. R. Ignatius, H. A. Arnold and others. July 45, declassified 15 Dec 53, 48p. Technical rept. 312-45.
Order from LC mi$3.30, ep$9.30 PB 146 556

This report was released for sale to the public 1 Aug 60.

From strategic considerations the basic offensive weapon of the German Navy in World War II was the submarine, even as it was in World War I. After the long naval holiday between 1918 and about 1935, the German submarine building program started with a clean slate. Numerous types were designed and actual construction ran into almost unbelievable numbers. Many design changes were made during the course of the war. The way ultimately led to the design of an intricate and interesting vessel based upon a new concept of submarine warfare, according to which submarines must remain submerged indefinitely, attain speeds heretofore considered impossible, operate at great depths, and must be highly maneuverable.

Naval Technical Mission in Europe.
LOSS OF THE GERMAN BATTLESHIP TIRPITZ ON 12 NOVEMBER 1944, by T. G. Springer and E. B. Hitchcock. Aug 45, declassified 2 July 59, 31p. 4 refs. Technical rept. 222-45.
Order from LC mi$3.00, ep$7.80 PB 146 552

This report was released for sale to the public 1 Aug 60.

The German Battleship "Tirpitz" while at anchor in Tromsoe Fiord, Norway on the morning of 12 November, 1944 was attacked by two (2) formations of British Lancasters which dropped a total of 29 "Tallboy" bombs. Each of these bombs had a total weight of 12,000 pounds including a 5,200 pound Tropex explosive charge. All bombs evidently landed to port of the ship's centerline. There was one confirmed direct hit and probably two others. At least seven bombs landed in the water within the torpedo net, two or three very close to the ship. There was extensive structural damage on the port side, and a tremendous amount of water swept into and over the ship. Efforts to keep the "Tirpitz" upright were unsuccessful and she capsized about 7 minutes after the first bomb struck. She is now resting on the bottom of Tromsoe Fiord at an angle of about 135 degrees with her superstructure buried in the mud.

Naval Technical Mission in Europe.
PROJECTED BATTLESHIPS OF GERMAN NAVY, CONSISTING OF TWO TYPES KNOWN AS "O" AND "H" AND SOME PROJECTED TYPES KNOWN AS "H" 41, "H" 42, "H" 43, AND "H" 44, by K. S. Brown and C. A. Stuelcken. Oct 45, declassified 2 July 59, 40p. Technical rept. 526-45.
Order from LC mi$3.00, ep$7.80 PB 146 557

This report was released for sale to the public 1 Aug 60.

Data has been assembled on the projected types of battleships to show the overall characteristics and to allow for a brief comment. A virtually complete set of contract plans for type "O" is furnished, as well as an assortment of contract plans and arrangement plans for type "H". Only the principal characteristics of types "H" 41, "H" 42, "H" 43 and "H" 44, are known.

Reed Research, Inc., Washington, D. C.
INVESTIGATION OF HULL-SUPERSTRUCTURE INTERACTIONS. Final rept. on Contract NObs-[72338]. Aug 58, 30p. 14 refs. AD-218 851L
Order from LC mi$2.70, ph$4.80 PB 146 674

Analytical studies and model experiments were made of the stresses induced in a destroyer by longitudinal bending loads, with particular reference to the stresses in the deckhouse and the main deck and the effect on these stresses of providing an expansion joint in the deckhouse. Several theoretical approaches are reviewed and some extensions are developed. Calculations by 4 different methods were made of the longitudinal stresses in the Q-1 deck for the portion of the deckhouse abaft the expansion joint. The loading of the ship, used for the computations, was that proposed for the full-scale test of the DD931 class destroyer. A common assumption in all the calculations was that the deck is infinitely stiff so that there is no vertical movement of the deckhouse relative to the hull.

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Food

Office of Technical Services, Dept. of Commerce, Washington, D. C.
FOOD PRESERVATION (EXCEPT BY IRRADIATION) (1950-1960). May 60, 10p. 125 refs. OTS Selective Bibliography SB-412.
Order from OTS $0.10 OTS SB-412

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. Reports are listed in categories as follows: dehydration, freezing, and food preservation, general.

Purdue U. Agricultural Experiment Station, Lafayette, Ind.
THE FEASIBILITY OF UTILIZING IONIZING RADIATION TO INCREASE THE STORAGE LIFE OF POTATOES, by M. Workman, N. K. Ellis, and M. Patterson. Rept. no. 11 (Final) for 1 Nov 56-30 Apr 59 on Contract DA 19-129-qm-789. [1959] 78p. File no. S-557; AD-233 086.
Order from LC mi$4.50, ph$12.30 PB 147 223

The influence of 5 dosages of gamma irradiation on White Sebago, Katahdin, Russet Burbank and Red Pontiac potatoes is described. The dosages used were 5.0, 7.5, 10.0, 12.5, and 15.0 kilorep. The potatoes were given different curing treatments. Storage was at 41°, 47°, and 55°F. Maximum storage period was two years. The influence of decay, weight loss, sprouting, internal discoloration, specific gravity and other factors is considered. (Author)

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Technical Operations, Inc., Burlington, Mass.
AN EXPERIMENTAL STUDY OF FRETTING AND GALLING IN DENTAL COUPLINGS, by John F. Batter and F. Everett Reed. Final rept. on Contract NObs-72304. June 58, 60p. Rept. no. TOI58-20; AD-212 761.
Order from LC mi$3.60, ph$9.30 PB 148 854

Specimens of materials used in dental couplings were tested in a simplified wear test machine which duplicated as closely as possible the actual wear conditions existing in operating couplings. The wear patterns that were obtained by tests of short duration on this machine duplicated those found in service. The results of tests covering the variables, load, speed, duration, amplitude of motion, surface finish and hardness are presented together with discussions of the effects of these variables. (Author)

Engines and Propulsion Systems

Air Force Special Weapons Center, Kirtland AFB, N. Mex.
AN INTRODUCTION TO NUCLEAR PROPULSION, by Kenneth R. Chapman. Apr 60, 49p. 18 refs. AFSWC-TN-60-9.
Order from LC mi$3.30, ph$7.80 PB 148 344

Propulsion of rocket vehicles by means of energy from the nuclear fission process is discussed in nonscientific terms. A single parameter (specific impulse) is used for comparing propulsion schemes. Nuclear and chemical rocket engines are compared; various means of using nuclear energy for rocket propulsion are described; a brief discussion and propulsion requirements in three selected missions is included. Appendixes clarify derivation of some equations used in the text and to introduce some reactor concepts to those readers not familiar with nuclear reactors. (Author)

Besler Corp., Emeryville, Calif.
DESIGN STUDY OF A STEAM POWER SYSTEM FOR A LANDING CRAFT, by William J. Besler and John L. Boyen. Rept. on Contract Nonr-2159(00). 30 Sep 57, 105p. AD-157 190.
Order from LC mi$5.70, ph$16.80 PB 146 571

Design studies were conducted on 775-hp steam-engine power plants. The units are to be quiet, flexible, light, inexpensive, efficient, and dependable for installation in high-performance landing craft. The specifications for the power system are summarized. The plant would be a compound steam engine with a forced-circulation boiler operating at 7400 lb/hr and 1200 psig at 760°F. The speed of the engine at full output would be 2200 rpm. The boiler efficiency would be about 83%, and the engine efficiency would be 76% (percentage of Rankine).

Lockheed Aircraft Corp., Sunnyvale, Calif.
A PROPULSION DEVICE USING AN EXPLODING-WIRE PLASMA ACCELERATOR, by W. L. Starr. Dec 58, 20p. LMSD-418 236.
Order from LC mi$2.40, ph$3.30 PB 147 640

A device that accelerates a plasma derived from an exploding wire to velocities of 8×10^6 cm/sec has been developed. A description of the experimental apparatus used and the results attained is given in this report. The impulse produced is about 10^3 dyne sec and, for a firing rate of 1 sec^{-1}, a thrust of 50 dynes/cm^2 is presently attainable. A brief analysis of the accelerating forces and their dependence on circuit parameters is also presented. Planned improvements should result in increases in both the impulse and propellant velocities. (Author)

Manufacturing Equipment and Processes

Brush Beryllium Co., Cleveland, Ohio.
FABRICATION OF BERYLLIUM WIRE, by A. G. Cross, Jr., R. G. O'Rourke, and W. W. Beaver. Progress rept. no. 2, 16 Dec 58-15 Feb 59, on Contract NOas-59-6030-C. [1959] 14p. 2 refs. AD-215 613.
Order from LC mi$2.40, ph$3.30 PB 149 617

Extensive true-stress - true-strain tensile testing was performed on hot-pressed QMV beryllium. Using analytical expressions, it is estimated that reductions in area at 850°F by wire drawing of at least 35% may be made between stress-relieving treatments. A process consisting of cold compacting canned powder by swaging, sintering the compacts to make extrusion blanks, and warm extruding the blanks to draw stock has been partially investigated. It was found that a critical compact green density existed. Swaging beyond this point destroyed the compact. Initial drawing experiments at 850°F have been made, and these indicate that large reductions in area per pass are more desirable than light reductions from the standpoints of surface and lubrication. (Author)

Naval Research Lab., Washington, D. C.
THE EFFECT OF NEUTRON IRRADIATION ON THE CHARPY V AND DROP-WEIGHT TEST TRANSITION TEMPERATURES OF VARIOUS STEELS AND WELD METALS, by J. R. Hawthorne and L. E. Steele. Final rept. 27 May 60, 28p. 4 refs. NRL rept. 5479.
Order from OTS $0.75 PB 161 448

Charpy V-notch and drop-weight specimens were used to determine changes in transition temperature for various steels and weld metals irradiated in different nuclear and thermal environments to integrated fast-neutron-flux exposures to 1×10^{19} NVT (>1.0 Mev). The Brookhaven Graphite Reactor, the Oak Ridge Low Intensity Test Reactor, and ARCO Materials Testing Reactor were used for the irradiations at temperatures under 200°F and at 575°F. Irradiations to integrated fast-neutron flux levels of 5×10^{18} NVT effected 40° to 100°F shifts in transition temperatures. Increasing the irradiation temperature from 200°F to 575°F significantly decreased the radiation-induced damage. Transition-temperature shifts in the order of 250°F were developed for materials irradiated at temperatures less than 200°F to an integrated fast-neutron flux dosage of 1×10^{19} NVT. Post-irradiation heat treatment revealed that recovery of properties may be obtained by 650°F annealing. Comparison of Charpy V and drop-weight nil-ductility transition temperature shifts for 17 material irradiations demonstrated excellent correspondence in the evaluation of irradiation effects by these two test methods. (Author)

Rodman Lab., Watertown Arsenal, Mass.
EPOXY RESIN DIES FOR INVESTMENT CASTING PATTERNS, by Francis C. Quigley and Eugene DeLuca. Dec 59, 8p. 6 refs. Rept. no. RPL 13/8; AD-234 073.
Order from LC mi$1.80, ph$1.80 PB 147 231

The resin system is compatible with the materials employed in the conventional die-making processes and can readily replace soft metal alloys as a casting medium in the production of wax pattern dies. The plastic die offers definite advantages over its metal counterpart including simplified construction, reduced handling weight, and reduced costs. The surface finish and dimensional reproducibility of wax patterns produced in a resin die parallel those of wax patterns produced in a machined, metal die. (Author)

Rodman Lab., Watertown Arsenal, Mass.
A MACHINING PRODUCTION FUNCTION, by Roy Mennell. Dec 59, 10p. 9 refs. Rept. no. RPL 23/10: AD-233 855.
Order from LC mi$1.80, ph$1.80 PB 147 232

A general production function is derived based on a generalization of machining data to describe all combinations of the inputs - tools and machines - necessary to give any production rate. A method is developed for solving for the minimum cost combination of inputs with the result that optimum number of machines assigned and cutting speed, as well as the resulting cost, are determined. (Author)

Stanford Research Inst., Menlo Park, Calif.
FEASIBILITY STUDY OF PLASMA WELDING OF REFRACTORY METALS, by Jess W. Wilson. Progress rept. no. 3, 1 Nov 59-1 Mar 60, on [Contract NOas-59-6234C] 22 Mar 60, 4p. SRI Proj. SU-2927.
Order from LC mi$1.80, ph$1.80 PB 148 425

The high power density and high heat transfer rate of a plasma jet make it of interest as a possible welding tool for the refractory metals, such as Ta, Mo, Ti, Zr, and W. The possible advantages of such an instrument are less contamination and a smaller heat-affected zone arising from the shorter heating times and consequently higher welding speeds. In this feasibility study the construction and operating characteristics of a small-diameter plasma torch are being studied. (See also PB 145 814)

Transport, Traction and Hoist Facilities

Arctic Aeromedical Lab., Ladd AFB, Alaska.
MODIFICATION OF WEAPONS CARRIER FOR CROSS COUNTRY USE OVER TUNDRA, SNOW AND SAND, by Jack Castle, Jr. Sep 57, 8p. Technical note AAL-TN-57-41.
Order from LC mi$1.80, ph$1.80 PB 146 631

It is recommended that the AC&W squadrons be furnished 3/4 ton vehicles equipped with U.S. Royal Knobby Implement tires 17:00 x 16 for use in unimproved areas, and that the modified vehicles be locked into the 4-wheel drive gear, thereby causing an even pull on all four wheels.

Detroit Arsenal, Center Line, Mich.
M-56 PNEUMATIC COMBAT BOGIE TIRE TESTS, by James K. Matter and Walter O. Perrott. 18 Nov 58, 50p. Rept. no. 4320 (Final).
Order from LC mi$3.30, ph$7.80 PB 146 532

George Washington U., Washington, D. C.
TIME-PHASING RELATIONSHIPS IN DETERMINING MERCHANT SHIP REQUIREMENTS FOR OVERSEAS CARGO LIFT. PART I. THE EXPORT-NO PIPELINE SYSTEM, by Ralph B. Hunt and Erling F. Rosholdt. Rept. on Logistics Research Project, Contract Nonr-761(05). 15 May 59, 92p. Serial T-101/59; AD-217 232.
Order from LC mi$5.40, ph$15.30 PB 146 585

A methodology is presented for determining the number of merchant ships required to transport known but possibly variable monthly quantities of export cargo between the continental United States and overseas ports. It pertains only to the situation where no pipeline or traffic exists and it is necessary to generate a pipeline from the beginning. The contributions to the necessary data made by the schedule of lift requirements and a ship's turnaround are discussed. The concept of notional ship and notional value is explained and a graphic method of analysis of the behavior of the pipeline as a function of turnaround time, delivery period and lift requirement schedule is developed and translated into complete sets of equations for calculating the pipeline build-up. The behavior of an export

shipping pipeline under the conditions of the study is illustrated for the cases of increasing, decreasing and variable monthly lift requirements for a sample group of turnaround times. (Author)

Land Locomotion Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
DETERMINATION OF VEHICLE SINKAGE PARAMETERS BY MEANS OF RIGID WHEELS. PART I. by T. Czako and M. G. Bekker. May 58, 37p. Rept. no. 33; AD-235 846.
Order from LC mi$3.00, ph$6.30 PB 147 242

The present way of determination of stress-strain parameters in soils by means of rectangular or round loading areas is time consuming and cannot be performed without alternate moving and stopping the measuring device over the terrain under measurement. To provide a quicker and continuous method of operation which would enable one to measure these parameters in a way more susceptible to automation, the use of rigid wheels instead of plates has been proposed. When towing such wheels under varying load, and measuring the corresponding sinkage, this new method of determining the discussed soil parameters was successfully tested in dry and wet sand. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
DEVELOPMENT AND TEST OF SLED TRAIN HOOKUP AND RELEASE DEVICES, by Douglas Taylor Final rept. 26 Jan 60, 41p. 6 refs. Technical rept. 047; AD-233 336.
Order from LC mi$3.00, ph$7.80 PB 146 728

A sled to tractor-or-sled hitch, a sled train safety release, and a drawpole elevating device were developed and tested. The sled to tractor-or-sled hitch could not be used with the tractor winch cable and was unsatisfactory. A torsilastic drawpole support, a modified Otaco drawpole spacer with Neidhart torsional springs at each end, was considered as a substitute for the drawpole elevating device. The tractor hitch with safety release device was mounted on a D2 LGP snow tractor and used by one man to couple and release a sled equipped with the drawpole elevator. These items are recommended for in-service test. (Author)

MATERIALS

Minnesota U., Minneapolis.
THE PLASTIC COEFFICIENTS FOR WORK-HARDENING MATERIALS, by W. H. Warner and P. Mahmoodi. Rept. for June-Oct 58, with revisions Mar-June 59 on Contract AF 33(616)5449. Apr 60, 17p. 8 refs. WADC Technical rept. 59-674.
Order from OTS $0.50 PB 161 886

In the establishment of the form of their generalized stress-strain law for work-hardening inelastic materials, Warner and Handelman did not show how the plastic coefficients could be evaluated in terms of material properties. This report first shows how this can be done, giving the general form of the coefficients for various states of stress. The validity of the assumptions behind this representation must be experimentally tested; comparison with existing results is carried out as far as possible. The conclusion suggests what types of experiments are needed to test the validity of the law, and if they are successful, what further experiments are needed to provide the information necessary to solve various combined stress problems analytically. (Author)

Office of Technical Services, Dept. of Commerce, Washington, D. C.
PHOTOGRAPHIC CHEMICALS AND EMULSIONS. June 60, 8p. 112 refs. OTS Selective Bibliography SB-417.
Order from OTS $0.10 OTS SB-417

A bibliography of reports listed in the two OTS monthly abstract journals: U.S. Government Research Reports and Technical Translations. Reports listed were added to the OTS collection during the period 1950 to July 1960.

Owens-Corning Fiberglas Corp., Newark, Ohio.
INVESTIGATION OF GLASS-METAL COMPOSITE MATERIALS, by Herbert B. Ailes. Annual progress rept. no. 2, 15 Mar 56-15 Mar 57, on Contract NOrd-15764. 29 Mar 57, 34p. 4 refs. AD-153 297.
Order from LC mi$3.00, ph$6.30 PB 149 620

Several major variables in the vacuum injection technique of compositing Al and Al-coated glass fibers were studied to obtain improved composite strengths. The best tensile strengths were obtained with 14S or 23S Al matrix alloys. It was possible to increase the glass concentration of a glass reinforced Al composite by heating the composite above the melting point of the Al alloy and allowing the Al to run out of the composite under the force of gravity. A glass reinforced Al bar 0.45 in. in diameter was hot rolled. Reductions of 1.5% pass resulted in a total reduction of 20%. A complete set of physical properties is being compiled on a standard composite of Al reinforced with Al-coated fibers. Composites of glass reinforced Al were made by hot pressing longitudinally oriented Al-coated fibers; measured strengths are presented. Orienting the fibers in 2 perpendicular directions decreased the strength by about 60%. Composites made of Al reinforced with bare glass fibers gave maximum strengths of 10,500 psi at 75°F. Glass reinforced Al tubes 1 in. in diameter made by the vacuum injection technique showed that rim stresses comparable to tensile strengths of the standard composites are feasible. (Author)

Adhesives and Sealants

Naval Weapons Plant, Washington, D. C.
COMPARISON OF ADHESIVE SYSTEMS FOR STRUCTURAL BONDING OF ALUMINUM, by Richard L. Nutt and William Lurie. 27 Apr 60, 9p. NWPW-T-8-60; NAVORD rept. 6953, Part 2.
Order from LC mi$1.80, ph$1.80 PB 148 359

Tensile lap-shear tests, using various combinations of primers and adhesives, were conducted at several temperatures to obtain comparative values for the NWP-developed adhesive system and several alternative systems for structural bonding of aluminum. Of all the systems tested, the NWP-developed system was found to have the best combination of satisfactory strength properties, and uniformity of strength level over the temperature range tested. (Author) (See also PB 148 358)

Naval Weapons Plant, Washington, D. C.
DEVELOPMENT AND EVALUATION OF AN ADHESIVE SYSTEM FOR STRUCTURAL BONDING OF ALUMINUM, by Ruth S. Kobler, William Lurie, and Richard L. Nutt. 20 Apr 60, 24p. 13 refs. NWPW-T-4-60; NAVORD rept. 6953, Part 1.
Order from LC mi$2.70, ph$4.80 PB 148 358

On the basis of a preliminary literature survey covering the field of adhesives and adhesion, an adhesive system formulation and associated fabrication techniques were selected and recommended for use in the developmental fabrication of the aluminum tail assembly of the LITTLE LULU weapon. In order to confirm the conclusions and recommendations derived from the literature survey, an evaluation of this adhesive system and its associated procedures was conducted. Effects of several processing variables were determined. The optimum combination of these variables resulted in average tensile lap-shear values (3728 psi at -67°F, 3736 psi at 83°F, and 2784 psi at 160°F) which were in excess of the requirements established for the system, and also in excess of the requirements of MIL-A-5090C. The peel strength test values obtained (approximately 21 in.-lb./in.) were considerably above those quoted in the literature for the individual constituents of the system. (Author)

Ceramics and Refractories

Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF SINTERABLE POWDERS AND PROPERTIES OF BERYLLIA CERAMICS, by James E. Johnson, A. J. Smalley, and Winston H. Duckworth. Rept. for 15 Feb-31 Dec 59 on Electrical and Electronic Materials, Contract AF 33(616)6238. Apr 60, 24p. 5 refs. WADD Technical rept. 60-108.
Order from OTS $0.75 PB 161 891

Information was developed on the effects of processing variables and microstructure on the fracture strength of ceramics made from sinterable oxide powders. The characteristic of high strength being associated with low porosities and small average crystal sizes was observed in ceramics of both MgO and BeO, but no quantitative correlation was found. Highest strengths were obtained when time and temperature of sintering were sufficient for densification above about 96 per cent of theoretical, provided that the sintering time and temperature was insufficient to give crystal sizes larger than the smallest observed, 5-6 microns for BeO ceramics and 10 microns for MgO ceramics. In the case of BeO powder prepared by pyrolysis of high-purity sulfate, calcining to an intermediate temperature (1700-1800°F) gave the powder that densified most readily when compacted and sintered, but one that did not have the greatest tendency toward crystal growth. The lack of quantitative correlations between bulk density, average crystal size, and strength, indicated that strength was affected by some factor or factors other than these two. (Author)

Cornell Aeronautical Lab., Buffalo, N. Y.
AN INVESTIGATION OF THE THEORETICAL AND PRACTICAL ASPECTS OF THE THERMAL EXPANSION IF CERAMIC MATERIALS. VOLUME 2. RESEARCH, by Henry P. Kirchner, Kenneth M. Merz, and Harold T. Smyth. Summary rept. for 1 July 58-31 Aug 59 on Contract NOrd-18419. 31 Aug 59, 49p. 17 refs. Rept. no. PI-1273-M-4; AD-227 766.
Order from LC mi$3.30, ph$7.80 PB 148 739

Attempts were made to predict the thermal expansion coefficient by 2 general methods, one in which an openness-ratio concept is used, the other in which statistical mechanics is applied. The results of these predictions were compared with data from the literature. A crude correlation seemed to exist between the the openness ratio and the thermal expansion coefficient. The thermal expansion coefficient decreased with increasing openness ratio for oxides and silicates. It seems likely that the openness ratio can be used to select low expansion phases from a large group of phases for which the thermal expansion coefficient is not known. This investigation did not result in sufficient experimental data to reach a definite conclusion on this point. The thermal expansion of phases having the sodium chloride structure can be predicted by using a statistical mechanical method. The results of the predictions were good considering the assumptions that were made. It may be possible to eliminate the assumption that the atoms vibrate independently of each other. (See also PB 161 826)

New York State Coll. of Ceramics, Alfred U.
THE HOT PRESSING OF FINE GRAINED CERAMIC OXIDES FOR USE IN THERMAL CONDUCTIVITY STUDIES, by R. K. Francis, J. J. Swica and others. Rept. for 1 Nov 58-31 Oct 59 on Surface and Interface Phenomena of Matter, Contract AF 33(616)3798. Feb 60, 32p. 8 refs. WADC Technical note 59-394.
Order from OTS $1.00 PB 161 851

The relationships between time, temperature, pressure and grain growth in hot pressing were studied using alumina grain to determine the techniques necessary for the production of dense polycrystalline alumina having a grain size in the four to five micron range. It was found that alumina having a density of the order of 95% of theoretical and grain size in the desired range could be produced using a short time at maximum temperature in hot pressing. (Author)

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
A METHOD FOR THE OBSERVATION OF THE INFRARED SPECTRUM AT HIGH TEMPERATURE VAPORS BY MATRIX ISOLATION. I. THE INFRARED SPECTRUM OF LITHIUM FLUORIDE, by M. J. Linevsky. Rept. on Contract AF 04(647)269. June 60, 18p. 8 refs. Technical Information Series R60SD387.
Order from LG mi$2.40, ph$3.30 PB 148 763

An apparatus has been developed that is capable of obtaining the infrared spectrum of matrix isolated vapor molecules generated by Knudsen effusion. The fundamental vibrational frequency of lithium fluoride has been observed in argon, krypton, xenon, and nitrogen matrices. Shifts in this frequency due to the interactions with the various matrices have been explained on a basis of a semi-classical model. (Author)

Fuels, Lubricants, and Hydraulic Fluids

Aeronautical Engine Lab , Naval Air Material Center, Philadelphia, Pa.
IGNITION CHARACTERISTICS OF SPECIAL JET ENGINE FUELS, by R. R. Ricci. Rept. on TED Proj NAM-PP502. 9 Feb 54, 55p. AEL-1282.
Order from LC mi$3.60, ph$9.30 PB 149 192

It is concluded from the results obtained on the tests conducted under this project that: (a) A correlation exists between fuel flow required for ignition and a definable volatility-viscosity characteristic. (b) Hydrocarbon class or structure, as an independent variable, does not appear to affect the fuel flow required for ignition. (c) At conditions of constant test chamber velocity and constant air and fuel temperature, variation in chamber pressure does not significantly affect the minimum fuel flow required for ignition. (d) At conditions of constant test chamber velocity the ignitable air-fuel ratio range will decrease as air and fuel temperatures decrease. (e) At conditions of constant test chamber pressure and air and fuel temperature the ignitable air-fuel ratio range will decrease with decreasing velocity. (f) The ignition characteristics of fuels must be considered as separate and distinct from the combustion characteristics and must not be interpreted as comparable to engine "starting" performance.

A[ir] F[orce] O[ffice] of S[cientific] R[esearch] Washington, D. C.
AFOSR CONTRACTORS' MEETING NO. 12 ON LIQUID PROPELLANT ROCKET COMBUSTION, MARCH 2-3, 1960, CO-SPONSORED BY PURDUE UNIVERSITY, LAFAYETTE, INDIANA. [1960] 16p. AFOSR-TR-60-37.
Order from LC mi$2.40, ph$3.30 PB 148 234

Contents:
Combustion in gaseous rocket motors
Interactions among burning fuel droplets
Theory of flame propagation
General solution to combustion instability
High frequency oscillatory combustion in rocket motors
Scaling procedures for liquid rockets
Observations of burning propellants in rockets
Acoustic instability in rocket combustion
Tangential instability in rocket chambers
Research on liquid rocket motors
Chemical kinetics
Radiation in rocket motors
Ions in rocket combustion products

Atlantic Research Corp., Alexandria, Va.
FURTHER STUDIES OF PURE AMMONIUM PERCHLORATE DEFLAGRATION, by Raymond Friedman and Joseph B. Levy. Rept. on Contract AF 18(600)1502. 28 Jan 60, 24p. 14 refs. AFOSR-TN-60-209; AD-233 370.
Order from LC mi$2.70, ph$4.80 PB 146 755

The effects of pressure, catalyst, and radiant energy were investigated on the burning rate of rocket propellants containing NH_4ClO_4. A deflagration rate-vs-pressure curve showed that pressed pellets of NH_4ClO_4, 4 mm square and 38 mm long, burned at essentially constant pressure in a nitrogen atmosphere. The lower pressure limit was extended from 45 to 22 atm. Experiments showed that the lower limit is insensitive to sample size and to the substitution of He for N as the ambient atmosphere. Small additions of copper chromite powder increased the lower pressure limit while the large additions decreased it. A radiant heating apparatus was developed to produce conditions which permit steady deflagration at atmospheric pressure. For pure NH_4ClO_4, there is a critical radiation level (10 cal/sq cm-sec) below which only slow sublimation occurs and above which deflagration occurs. The deflagration rate is essentially linear with radiation flux and extrapolates to a finite rate at zero radiant flux. The addition of Cu-0202 catalyst increased the deflagration rate and reduced the threshold flux required for ignition. The chemical composition of the product gases from deflagrating NH_4ClO_4 were investigated at pressures from atmospheric to 2000 psi, both with and without the copper chromite catalyst. The gaseous products were N, N_2O, and O.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.
BIBLIOGRAPHY AND SOURCE MATERIAL ON NITRIC ACID WITH EMPHASIS ON ITS USE AS AN OXIDIZER FOR ROCKET FUELS, by K. Elsas. Rept. on Proj. Loki, Contract W30-069-ORD-4450. 31 Dec 51, declassified, 29p. 188 refs. Rept. no. 515-801; ATI-129 118.
Order from LC mi$2.70, ph$4.80 PB 148 493

The study is concentrated on factors affecting the decomposition of the nitric acid. Also, only very strong nitric acids can be of value as oxidizers for rocket-fuels and therefore references to dilute solutions of nitric acid, and to other non-rocket aspects of nitric acid technology, have been neglected beyond very cursory considerations.

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RESULTS OF PERFORMANCE CALCULATIONS FOR N_2O_4–N_2H_4 BIPROPELLANT SYSTEM, by G. W. Elverum, Jr. and J. S. Martinez. Rept. on Contract DA 04-495-ORD-18. 3 July 58, 64p. 3 refs. Memo. no. 20-174; AD-211 722.
Order from LC mi$3.90, ph$10.80 PB 147 436

Results are presented for all the performance calculations completed to date at the Jet Propulsion Laboratory on the N_2O_4-N_2H_4 liquid bipropellant system. All the results included were calculated by the constant-entropy method. (Author)

Little, Arthur D., Cambridge, Mass.
HANDBOOK FOR HYDROGEN HANDLING EQUIPMENT, by B. M. Bailey, D. C. Benedict and others. Rept. for 1 May 58-31 July 59 on Contract AF 33(616)5641. Feb 60, 589p. 226 refs. WADC Technical rept. 59-751; AD-235 123.
Order from OTS $7.00 PB 161 835

This handbook provides engineering data concerning the most adequate, safe, and economical procedures and equipment for liquid hydrogen storage, transfer, and ground servicing systems. The engineering data developed centers on the requirements for (1) storage vessels, (2) transfer lines, (3) pumping systems, (4) valves, (5) instruments, and (6) recondensing systems. Results, conclusions and recommendations are reported in separate chapters classified in accordance with the above listed hardware items. (Author)

Massachusetts Inst. of Tech., Cambridge.
HYDROGEN PEROXIDE LABORATORIES, by W. C. Schumb and C. N. Satterfield. Quarterly periodic status rept. on Contract Nonr-1841(11). 30 Sep. 59, 9p. AD-228 153.
Order from LC mi$1.80, ph$1.80 PB 148 871

Stability studies: Experiments showed that a definite increase in the decomposition rate of H_2O_2 solutions occurs at low concentrations. The rate is practically constant down to about 10 to 12 wt-% H_2O_2, but triples at 3 wt-%. Hydrogen peroxide decomposition flame at sub-atmospheric pressures: The superheater area was increased, and the stopcock and stopcock grease were eliminated so that the apparatus consisted of the boiler flask and superheater in one unit. The burner tube was connected to the superheater by a flexible joint and enclosed in an externally heated Cu tube. The top of the burner tube was connected to the sampling condenser. The vapor coming from the burner tube was ignited by a hot wire. Usable photographs of the flames were obtained. Porous-walled reactor studies: Experiments made in the porous reactory by using CO_2, He, and N as carrier gases confirmed the results previously reported and indicated the strong effect of the diffusivity of H_2O_2 in the carrier gas. Similar experiments in a plain Pyrex reactor of the same size which was operated at 215°C produced rate constants 10 to 100 times lower than those recorded in the porous reactor. Decomposition of H_2O_2 vapor on catalytic surfaces: The modified apparatus failed to produce consistent results. (See also PB 146 281)

Naval Air Rocket Test Station, Lake Denmark, Dover, N. J.
ANALYTICAL PROCEDURES FOR ROCKET PROPELLANTS. VII. MIXED ACID, by John D. Clark. Sep 52, 20p. 4 refs. Rept. no. 24.
Order from LC mi$2.40, ph$3.30 PB 149 185

The conventional method of analyzing mixed acid (nitric acid, approximately 15% sulfuric acid, plus small quantities of water and NO_2) is discussed, and the inherent inaccuracies in the method are pointed out. A new method of analysis of mixed acid, based upon a conductimetric titration of the sulfuric acid after interfering ions have been substantially eliminated, is described. This method is free of the inherent disadvantages of the conventional method, is faster, and appears to be capable of an appreciably higher degree of precision and accuracy. (Author)

Naval Engineering Experiment Station, Annapolis, Md.
A COMPARISON OF THE RELATIVE EFFECTIVENESS OF n-CETANE AND PARAFFINIC GAS OIL IN DIESEL FUEL COMPATIBILITY TESTS, by R. T. Jones. 16 Dec 57, 17p. 3 refs. Research and development rept. 070129E; AD-205 173.
Order from LC mi$2.40, ph$3.30 PB 147 442

Filter-clogging, screen-clogging, and accelerated stability test procedures were used. Data illustrating the mechanism of the type of incompatibility involved were obtained. The gas oil was not equivalent to cetane in detecting incompatibility in the filter- and screen-clogging tests used. With suitable adjustments, the gas oil gave results comparable to those obtained with cetane in the accelerated stability test. However, n-cetane was found to have certain advantages over the gas oil in this test.

Naval Ordnance Test Station, China Lake, Calif.
DIFFUSION IN A TWO-LAYER SLAB WITH TABLES OF CONCENTRATION, by D. R. Cruise and C. J. Thorne. 21 May 59, 403p. 7 refs. NOTS TP 2146; NAVORD rept. 6439; AD-234 065.
Order from LC mi$11.10, ph$62.10 PB 147 250

The linear problem of diffusion between a layer of high concentration and a layer of low concentration in solid rocket propellants is solved and the results tabulated for a substantial range of the parameters involved. (Author)

Naval Research Lab., Washington, D. C.
THE STABILIZATION OF SILICONE LUBRICATING LIQUIDS ABOVE 200°C. PART I. CONVENTIONAL OXIDATION INHIBITORS AND SOME HIGH-SURFACE SOLIDS, by H. R. Baker, F. F. Sullivan, and C. R. Singleterry. Interim rept. 2 June 60, 33p. 16 refs. NRL rept. 5457.
Order from OTS $1.00 PB 161 314

A study of the stabilization of silicone oils at temperatures between 250° and 371°C has shown that the useful life of the commercially available types may be extended from three to five times by the use of certain oxidation inhibitors known to be effective in other systems. The relative value of different inhibitors varies with the temperature and the aromatic content of the oil. The deterioration of silicones in this temperature range is primarily an oxidative process. This oxidation is inhibited by high-surface solids such as Shawanigan black, copper phthalocyanine, and ferric oxide, by conventional inhibitors of the arylamine type, and by dilauryl selenide. Dilauryl selenide was ineffective at 300°C and higher; phenylalphanaphthylamine caused a relatively uniform improvement at 250° and 300°C. The gains from any inhibitor were small at 371°C. The chemical diversity of the effective inhibitors and the relatively high temperatures at which they are effective suggest that the mechanism of inhibition differs from that operating in conventional oils at temperatures below 200°C. The improvements shown with lightly phenylated silicones permit formulation of lubricants having acceptable viscosity characteristics and oxidation stability over the range from -55°C or lower to 305°C. This work has led to the discovery of new

types of inhibitors, specifically for use with silicone liquids, which are an order of magnitude more effective than conventional inhibitors. (Author)

North Carolina State Coll., Raleigh.
LUBRICATION BEHAVIOR OF LIQUID METALS, by Patrick H. McDonald. Rept. for July 58-Sep 59 on The Structure and Properties of Interfaces, Contract AF 33(616)5885. Mar 60, 76p. 16 refs. WADC Technical rept. 59-764.
Order from OTS $2.00 PB 161 888

This report describes the investigation of the lubricating behavior of liquid metals in two categories: hydrodynamic and boundary lubrication. The basic theory of the hydrodynamic study is that of the Reynolds equation. This theory has been extended, after the manner of Christopherson, to a new state of development in this report. An experimental device has been designed and constructed for confirming this theory as it relates to liquid metals. The complex and elaborate aspects of this apparatus are described in detail in the report. The study of a variety of liquid metals with this apparatus is anticipated. A macroscopic theory of the boundary lubrication region has been employed. This theory has been applied to a cylinder-flat combination, and the lubricating behavior has been seen to depend upon the state of contact stress for this configuration. An apparatus for these investigations is also described in the report. (Author)

Ohio State U. Research Foundation, Columbus.
DETONATION INDUCTION DISTANCES IN COMBUSTIBLE GASEOUS MIXTURES AT ATMOSPHERIC AND ELEVATED INITIAL PRESSURES, IV. HYDROGEN-NITRIC OXIDE. V. HYDROGEN-OXYGEN-DILUENT. VI. THEORETICAL ANALYSIS, by Loren E. Bollinger, Michael C. Fong, and Rudolph Edse. Final technical rept. on Contract AF 33(616)5615 continuation on Contract AF 33(616)3913. Aug 59, 86p. 19 refs. WADC Technical rept. 58-591, Pt. II.
Order from OTS $2.25 PB 161 878

Experimental measurements have been made to determine the detonation induction distances in hydrogen-nitric oxide mixtures and in hydrogen-oxygen-diluent mixtures in a 50-mm diameter tube for various diluent concentrations at initial pressures of 1 and 5 atmospheres and an initial temperature of 40°C. Detonation could not be obtained in the 12-foot long tube with any of the hydrogen-nitric oxide mixtures used at initial pressures of 1, 5, or 10 atmospheres. Nitrogen, helium, argon, and carbon dioxide were the individual diluents which were added to a stoichiometric mixture of hydrogen and oxygen. Addition of any of the diluents caused an increase in the detonation induction distance by varying amounts. For a given volume of diluent, carbon dioxide caused the greatest increase in induction distance while the addition of argon resulted in the least increase. A theoretical analysis of the formation of a detonation wave has been made. A correlation function was found which relates the detonation induction distanc to the Reynolds number, the normal burning velocity of the mixture, the sonic velocity of the unburned gas, and the adiabatic combustion temperature of the given mixtures. (See also PB 151 873)

Olin Mathieson Chemical Corp [Baltimore, Md.]
STUDY OF SUPEROXIDIZERS, by F. O. Penzig. Interim rept. for 5 June 58-4 June 59 on Energy Transfer Research, Contract AF 29(600)1667. Feb 60, 21p. 20 refs. AFMDC-TN-60-3; AD-234 301.
Order from LC mi$2.70, ph$4.80 PB 146 633

This report presents the investigation of new methods for the preparation of higher oxides of hydrogen, a study and evaluation of reported techniques for the preparation of higher oxides of hydrogen, and the development and refinement of analytical methods. The methods include the reaction of hydrogen atoms with liquid ozone, irradiation of dilute hydrogen peroxide solutions, reaction of ozone and oxygen with organic and inorganic materials, electrolysis of hydrogen peroxide, and dissociation of water vapor by electric discharge. The reaction of hydrogen atoms with ozone produced a compound containing hydrogen and oxygen in a molar ratio corresponding to H_2O_4 or HO_2. Condensation of dissociated water vapor produced a mixture of H_2O_2, and higher oxides.

Rock Island Arsenal Lab., Ill.
THE EFFECT OF HUMIDITY ON THE CONSISTENCY OF GREASES, by Max T. Fischer. 27 Apr 60, 14p. 2 refs. Rept. no. 60-1309.
Order from OTS $0.50 PB 161 861

When certain nonsoap thickened-mineral oil greases exhibited shear breakdown after storage at low humidity, greases of other types were stored at several humidities to determine their effect on storage and shear stability. Worked and unworked quarter scale penetrations in a miniature grease worker cup were obtained on surface and subsurface grease samples stored in four ounce ointment cans at 0, 50 and 100% relative humidities maintained in desiccators for as long as seven months. When storage or use of greases in high or low humidity environments is anticipated, the stability of individual products should be ascertained since moisture stable and unstable greases of some soap and nonsoap thickened types are available. The soap thickened-mineral oil greases are more likely to be stable to the effects of moisture than are the soap thickened synthetic fluid or nonsoap thickened greases.

Leather and Textiles

Bjorksten Research Labs., Inc., Madison, Wis.
DEVELOPMENT OF TEXTILE TYPE VITREOUS SILICA YARNS, by W. Wendall Drummond and Burns A. Cash. Rept. for Feb-Sep 59 on Air Force Textile Materials, Contract AF 33(616)6255. Mar 60, 53p. WADC Technical rept. 59-699.
Order from OTS $1.50 PB 161 845

Experiments were performed leading to development of methods for producing vitreous silica textile yarns from fused quartz canes or rods by means of electrical heating devices. Both induction and resistance furnace devices were used, best performance being obtained from a resistance unit shielded against radiation losses and operating in a protective atmosphere. Power capabilities of available equipment

were insufficient to permit production of a large number of continuous filaments simultaneously, but operation with five filaments was achieved. A limited amount of data on physical properties of filaments and strands was obtained. (Author)

Naval Ordnance Lab., White Oak, Md.
WAFFLE-TYPE CORE MATERIAL FOR SANDWICH CONSTRUCTION, by H. A. Perry, Jr. 7 July 58, 29p. 38 refs. NAVORD rept. 6100; AD-206 315.
Order from LC mi$2.70, ph$4.80 PB 147 222

A fabricated core material is described which consists of a single sheet with symmetrical truncated pyramidal indentations, alike on both sides, resembling the geometry of a waffle. A waffle core of rigid sheet material when bonded between two flat, high strength faces, produces a strong, light-weight structure. Two separate channels exist for the flow of heat-transfer media in the plane of the sheet. The "Waffle" type of sandwich construction appears potentially to be of considerable value in the fabrication of aircraft parts, radomes, a solid blast protective flooring and heat exchangers. It offers a solution to aircraft de-icing and flight cooling problems. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
APPARENT THERMAL DIFFUSIVITY OF FABRICS, by James J. Powers and Francis W. Botsch. Feb 60, 22p. 7 refs. Technical rept. EP-126; AD-233 365 and AD-234 969.
Order from LC mi$2.70, ph$4.80 PB 148 652

The concept of thermal diffusivity is applied to fabrics and fabric systems in order to provide a parameter for the mathematical analysis of the thermal response of clothing to non-uniform boundary conditions. Particular solutions of the Fourier Conduction Equation for unidimensional heat flow are discussed for a thick slab of cloth and for a semi-infinite solid composed of fabric layers. Four experimental methods are applied in the determination of the apparent thermal diffusivity of cloth, using boundary step changes and periodic variations in temperature. The apparent thermal diffusivity of blanket cloth was found to be .0225 in.^{2}/min. and that of Nylon 66 to be .0030 in.^{2}/min. (Author)

Paints and Finishes

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
ALKALINE-ORGANIC MISSILE COMPONENT PAINT REMOVERS, by A. Mankowich. Rept. 1, 10 June 59, 27p. 1 ref. Rept. no. CCL-78; AD-220 378.
Order from OTS $0.75 PB 161 859

Stable, single phase, alkaline-organic paint removers have been developed suitable for stripping paint from missile component parts of aluminum and magnesium. Bench tests indicating improvement in stripping efficiency of 50 to 75 percent over that of the best conventional alkaline aluminum strippers were confirmed by field tests at an Ordnance Depot. The addition of specific high boiling-high flash point glycols and/or triols and hydroxyalkylamines to conventional alkaline aluminum strippers produced the stable, single phase paint removers of improved efficiency. Exploratory tests indicated that certain cationic dispersing agents could replace the fatty acid or rosin soaps of the developed formulations. (Author)

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
RAPID DETERMINATION OF ANTIMONY TRIOXIDE IN FIRE RETARDANT PAINT, by G. G. Esposito. 26 Apr 60, 7p. 1 ref. CCL no. 93.
Order from LC mi$1.80, ph$1.80 PB 146 678

The method presented provides an accurate, rapid volumetric determination of antimony trioxide in the presence of lead chromate by a modification of the iodine process. The method is based upon the reduction of antimony with potassium iodide followed by selective oxidation of the trivalent antimony to the pentavalent form with iodine in the presence of sodium bicarbonate. (Author)

Naval Research Lab., Washington, D. C.
EFFECT OF TEMPERATURE ON THE LUMINANCE OF PHOSPHORESCENT AND FLUORESCENT MATERIAL USED FOR AIDS TO MILITARY ACTIVITY IN THE DARK, by L. J. Boardman. Interim rept. 26 Oct 59, 11p. NRL rept. 5380.
Order from OTS $0.50 PB 161 005

The effect of temperature on the luminance of various types of aids to military activity under covery of darkness has been measured at temperature ranging between -60° and 200°F. The luminance of fluorescent materials appears to have a maximum value near 75°F with very little change between 60° and 80°F and dropping no more than 20 percent at the extreme temperatures. The luminance characteristics of phosphorescent materials were affected markedly by the temperature. For a constant intensity of excitation, phosphorescent materials appear to have a maximum intensity at about 75°F. The luminance-decay rate of both a high initial brightness (HIB) and low initial brightness (LIB) material was increased with increasing temperatures. At higher temperatures, above 75°F, the rate of luminance decay of the HIB material was so rapid that its usefulness was destroyed. Below 75°F the rate of luminance decay was greatly retarded until at -60°F the luminous life for both the HIB and LIB specimens is about equal. Temperature has essentially no effect on the luminance of the radioactive self-luminous materials throughout the range used in this series of measurements (-60° to 150°F). However, at about -60°F the luminance begins to drop appreciably. A comparative measure of the absorbed phosphorescent energy at various temperatures of a constant irradiation was made.

Naval Research Lab., Washington, D. C.
THE PROPERTIES OF PAINTS AS AFFECTED BY ULTRAVIOLET RADIATION IN A VACUUM. PART I, by F. M. Noonan, A. L. Alexander, and J. E. Cowling. Interim rept. 13 July 60, 41p. 10 refs. NRL rept. 5503.
Order from LC mi$3.30, ph$7.80 PB 146 488

The control of temperature is a problem of major concern to the designers of spacecraft. The exchange of energy between a vehicle in space and its surroundings is limited to the radiation process. The idea of using paint on a space vehicle is very attractive, because a properly chosen paint might afford a practical, relatively convenient means of controlling the absorption and emission of radiant energy by the craft, thereby achieving temperature control. This report is concerned with the study of film-forming resins in a high vacuum under the influence of ultraviolet irradiation.

Plastics

Naval Ordnance Lab., White Oak, Md.
AN ADIABATIC CALORIMETER FOR THE DETERMINATION OF THE SPECIFIC HEATS OF CASTING RESINS, by R. W. Warfield, P. Donovan, and M. C. Petree. 8 Mar 58, 31p. 15 refs. NAVORD rept. 6094; AD-162 973.
Order from LC mi$3.00, ph$6.30 PB 148 450

The report describes an adiabatic calorimeter, with temperature controlling and measuring instrumentation, which has been developed for the determination of the specific heat of casting resins as a function of temperature over the range 30°C to 160°C. Results are presented for a number of typical casting resins. In some resins changes in specific heat values are observed which are indicative of second order transitions. (Author)

Oxford U. (Gt. Brit.)
SYMPOSIUM ON PLASTIC CRYSTALS AND ROTATION IN THE SOLID STATE, by J. G. Aston (Pennsylvania State U.) L. A. K. Staveley, and L. E. Sutton. Final rept. on Contract DA 91-591-EUC-1416. 8 Apr 60, 19p.
Order from LC mi$2.40, ph$3.30 PB 147 935

This report summarizes the papers presented, gives the names of invited guests and a partial list of those attending the Symposium on Plastic Crystals. Included also is a summary of the discussion on each paper and of the opportunities for individual discussion.

Resin Research Labs., Inc., Newark, N. J.
STEREOSPECIFIC THERMOSETTING RESINS AND HIGH HEAT RESISTANT ADHESIVES, by P. Esemplare, R. Saltzman and others. Interim rept. no. 4, 1 Feb 59-31 Mar 59, on Contract NOas-58-870-c. 7 Apr 59, 10p. Rept. no. 704; AD-229 178.
Order from LC mi$1.80, EP $3.30 PB 148 388

A statistical study was undertaken to determine the effect of Tergitol NP27 on the standard resin which involved the addition of the micelle former in successively greater percentages to the standard resole formulation. Results indicated that the greater the percentage of Tergitol, the lower the flexural strength. The strength retention was greater for a larger percentage of Tergitol of about 10%. Optimum concentration appeared to be about 12.5%. Two opposing forces appeared to exist. Glass cloth reinforced laminates were prepared, tested, and heat aged. A comparison was made between the standard resole (RRL-39-83) and a commercially available high-heat resistant resin. Both resins were laminated, heat aged for 24 hr at 500°F, and tested similarly. Preliminary results indicated that the standard resole had a strength retention upon heat aging approximately twice that of the commercial resin.

Rubber and Elastomers

Institute of Rubber Research, U. of Akron, Ohio.
STRESS RELAXATION AND STRUCTURE OF HIGH TEMPERATURE ELASTOMERS, by Maurice Morton, V. R. Allen, and R. D. Gates. Technical rept. no. 5, 1 June-31 Aug 59, on Contract Nonr-2573(00). [1959] 28p. 6 refs. AD-228 633.
Order from LC mi$2.70, ph$4.80 PB 148 600

It has been assumed that degradation during press-heating of an extracted vulcanizate is comparable to degradation during vulcanization. Based on this assumption, calculations have been made to correct for the effect of degradation during crosslinking on the sol fraction and the degree of crosslinking. The corrected sol fraction is considerably greater than proposed by theory for natural rubber peroxide vulcanizates. Further, the deviation from theory is dependent on the original molecular weight of the primary chains. The number of chain entanglements per chemical crosslink has then been calculated, assuming that the deviation is attributable to such entanglements. It was proposed that the effectiveness of chain entanglements, i.e., number of apparent physical crosslinks, may be a function of the extent of applied strain on the network. It was found that the number of network chains, as measured by equilibrium swelling, was slightly higher for a good solvent (carbon tetrachloride) than for a poorer solvent (benzene). A sample of Viton A cured with Diak No. 1 exhibited greater resistance to high temperature degradation than did a triethylene tetramine-piperazine cure as evidenced by stress-relaxation studies. With the Diak No. 1 cure, very little change occurred in the stress-relaxation curve when the temperature was raised from 150°C. to 240°C. When raised to 275°C., however, degradation proceeded much more rapidly. (Author) (See also PB 146 230)

Material Lab., New York Naval Shipyard, Brooklyn, N. Y.
INFLUENCE OF MOLECULAR STRUCTURE AND SUBSTITUENTS ON THE ANTIZONANT PROPERTIES OF ARYL DIAMINE CHEMICALS, by A. E. Ruff and A. D. Delman. Research and development rept. 4 Mar 57, 25p. 14 refs. Final rept. on Lab Project 5850-A-2.
Order from LC mi$2.70, ph$4.80 PB 149 549

The influence of molecular structure and substituents on the antiozonant properties of fourteen related aromatic diamine chemicals was investigated in terms of their relative effectiveness as inhibitors of ozone-induced polymer degradation. Results, obtained by viscometric techniques, indicate that symmetrical compounds are superior, as antiozonants, to analogous unsymmetrical compounds. In addition, the protective capacities of the antiozonants vary inversely

with the size, number of N-hydrogen substituents, and the distance between the amine groups. The relative effectiveness of the chemicals investigated is correlated with free radical stability, in accordance with the theory of resonance. (Author)

Rock Island Arsenal Lab., Ill.
LOSS OF ANTIOZONANT EFFICACY IN BUTADIENESTYRENE (SBR) RUBBER AFTER SHELF STORAGE, by E. W. Bergstrom. 25 Feb 60, 17p. 2 refs. Rept. no. 60-487; AD-234 723.
Order from LC mi$2.40, ph$3.30 PB 147 339

An investigation was carried out to determine the ozone resistance of (1) antiozonant inhibited SBR vulcanizates which had been stored unstressed indoors and outdoors for various periods of time and (2) vulcanizates prepared from the same inhibited compounds after storage uncured, indoors for various periods of time prior to curing. It was found that vulcanizates inhibited with N-phenyl-N'-cyclohexyl-p-phenylenediamine have excellent ozone resistance in accelerated (25 and 50 pphm) ozone tests when the vulcanizates are stressed and exposed to ozone within three days from the date they are cured. However, the same vulcanizates have no ozone resistance in accelerated ozone tests after being stored (1) unstressed indoors for one week or longer and (2) unstressed outdoors for a period of one month or longer. All antiozonant inhibited SBR vulcanizates which had been stored unstressed for periods up to 24 and 30 months both indoors and out had excellent ozone resistance in outdoor tests.

Rock Island Arsenal Lab., Ill.
OZONE RESISTANCE OF BUTYL VULCANIZATES, by E. W. Bergstrom. 16 May 60, 18p. 11 refs. Rept no. 60-1593.
Order from LC mi$2.40, ph$3.30 PB 148 366

An investigation was carried out to determine the ozone resistance of Butyl (IIR) vulcanizates compounded using formulations recommended by the rubber manufacturer for maximum ozone resistance. These formulations contained high wax loadings. Nonhalogenated IIR vulcanizates prepared using these formulations had excellent ozone resistance in accelerated static tests when exposed to 25±3 pphm ozone and in outdoor static tests when exposed at a stress of 20 percent. They had poorer ozone resistance (1) in accelerated static tests when exposed to 50±5 pphm ozone, (2) in dynamic tests and constant load tests when exposed to 25±3 pphm ozone and (3) when exposed outdoors in bent loop fixtures. Chlorinated IIR vulcanizates prepared using the recommended formulations had poor ozone resistance in accelerated static tests when exposed to either 25±3 or 50±5 pphm ozone. The vulcanizates had excellent ozone resistance in outdoor tests, however, when exposed at a stress of 20 percent.

Rock Island Arsenal Lab., Ill.
STYRENE POLYMERIZATION DURING THE MILLING OF DIENE RUBBERS, by H. Wolfgang Jureleit. 28 May 59, 23p. 4 refs. Rept. no. 59-1448; AD-217 043L.
Order from LC mi$2.70, ph$4.80 PB 147 341

A method is described to polymerize styrene during the milling process of an elastomer, such as polybutadiene or a copolymer of butadiene and acrylonitrile. This "mill polymerization" was initiated by finely dispersed sodium and by sodium alcoholate. The developed method does not require any solvents or special apparatus. The experiments were performed on a conventional 2-roll rubber mill. Analysis of the final polymer compositions resulting from the mill polymerization indicates that most probably "graft polymers" are formed by this method. The results also indicate that the milling of uncured elastomers with sodium dispersion might be developed into a new method of vulcanizing without sulfur or sulfur-containing compounds. (Author)

Rock Island Arsenal Lab., Ill.
SYNTHESIS OF STEREOREGULATED HOMOPOLYMERS AND COPOLYMERS OF BUTADIENE AND STYRENE, by Ronald R. Freeman. 5 Jan 60, 28p. 10 refs. Rept. no. 59-3286; AD-233 875L.
Order from LC mi$2.70, ph$4.80 PB 147 230

Results are presented on the homopolymerization of butadiene and styrene and the copolymerization of butadiene with styrene using triethyl aluminum and titanium tetrachloride (Al-Ti) as catalysts.

MATHEMATICS

Aeronautical Research Associates of Princeton, Inc., N. J.
BEHAVIOR OF SOLUTIONS OF THE NAVIER-STOKES EQUATIONS FOR A COMPLETE CLASS OF THREE-DIMENSIONAL VISCOUS VORTICES, by Coleman duP. Donaldson and Roger D. Sullivan. Rept. on Contract AF 49(638)255. May 60, 32p. 11 11 refs. AFOSR-TN-60-172.
Order from LC mi$3.00, ph$6.30 PB 148 027

A study has been made of the complete class of solutions of the Navier-Stokes equations wherein the radial, tengential, and axial velocities in cylindrical coordinates (r, ϕ, z) are the forms $u = u(r)$, $v = v(r)$, and $w = zw(r)$. These solutions are found to represent a rather large class of three-dimensional viscous vortex motions. The class of solutions contains Burgers' analytic solution for an unconstrained one-celled vortex as a special limiting case. The solutions obtained show that vortex motions are possible which have more than one "cell". That is, the flow may not simply spiral in toward an axis and out along it as in a one-celled configuration but may have nested regions of successively reversed axial flow. The behavior of the solutions in passing from single to multiple-celled configurations is discussed and the solution for the extremely interesting case of a two-celled analogue to Burgers' unconstrained vortex, which probably occurs quite often in nature, is given in closed form.

Air Force Missile Development Center, Holloman AFB, N. Mex.
FIGURES OF MERIT OF TRANSFER FUNCTIONS AS RATIONAL FUNCTIONS OF THEIR COEFFICIENTS, by Herbert Knothe. Jan 60, 25p. AFMDC TR-60-3; AD-233 558.
PB 146 378

General methods and explicit formulas in terms of the coefficients of a linear differential equation are developed to express figures of merit for the response of a linear system to a step input.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
DYNAMIC INVENTORY POLICY WITH VARYING STOCHASTIC DEMANDS, by Samuel Karlin. Technical rept. no. 15 on Contract Nonr-225(28). 24 Sep 59, 58p. 14 refs. AD-227 373.
Order from LC mi$3.60, ph$9.30 PB 148 894

An extended version of the classical Arrow, Harris, Marschak dynamic inventory process is presented. The case for a single commodity is considered. A sequence of ordering decisions is made at the beginning of a number of periods of equal duration, which result in the buildup of inventories. Stock is depleted by consumption (demand), which is assumed to be an observation of a random variable with a known distribution function. All distribution functions are assumed to possess continuous densities and to belong to nonnegative random variables. A general proof is given for the fact that with a linear ordering and arbitrary independent demand distribution through successive periods, the optimal policy in each period is determinec by a single critical number. With the characterization of the optimal policy known, the main theorem is proved pertaining to comparisons of the critical numbers under the hypothesis that the demand densities are suitably stochastically ordered.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
THE SEQUENTIAL DESIGN OF EXPERIMENTS FOR INFINITELY MANY STATES OF NATURE, by Arthur E. Albert. Technical rept. no. 47 on Contract N6onr-25140. 3 Aug 59, 88p. 9 refs. AD-220 544.
Order from LC mi$4.80, ph$13.80 PB 148 158

The results of Chernoff's sequential design (Ann. Math. Stat. 30: 1959) are extended to the case where the possible states of nature are infinite in number. The assumption is made that there are 2 possible actions (terminal decisions) and a class of available experiments. After each observation, the statistician decides whether or not to continue. If he decides to continue, he must select one of the available experiments; if he decides to stop, he must select one of the 2 terminal actions.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
THREE HYPERBOLIC SURFACES WITH UNUSUAL PROPERTIES, by Robert Osserman. Technical rept. no. 14 on Contract DA 04-200-ORD-704. 19 Feb 60, 14p. 8 refs. OOR rept. 1323.18-M.
Order from LC mi$2.40, ph$3.30 PB 148 436

This paper gives examples of simply-connected surfaces which exhibit various types of unusual behavior. The first example is a polyhedral surface of the form $z = f(x, y)$ over the whole x, y-plane, for which an explicit quasiconformal map is given onto the interior of the unit disk. The second is a complete simply-connected minimal surface which is conformally equivalent to the unit disk. The third is the Riemann surface of the inverse to a function analytic in the unit disk.

Battelle Memorial Inst., Geneva (Switzerland).
THEORETICAL STUDY ON HOMOTOPY THEORY AND DUALITY FOR MODULES AND SPACES. Final and annual technical rept. no. 1. 1 Feb 59-31 Jan 60, on Contract DA 91-591-EUC-1060. 29 Feb 60, 14p. 3 refs. AD-234 398.
Order from LC mi$2.40, ph$3.30 PB 147 255

Homotopy groups of two variables and their duality properties are studied both in the algebraic and in the topological context. On the algebraic side, the theory of these groups and their exact sequences is built up in a most general framework. The results are then applied to special cases and interrelated with known algebraic concepts, primarily for modules over a ring. On the topological side, algebraic topology is shown to be obtainable from the groups, their exact sequences, and the related concepts. The new concepts and results suggested by the duality are investigated. (Author)

California U., Berkeley.
ON SINGULAR PARTIAL DIFFERENTIAL BOUNDARY PROBLEMS, by Frantisek Wolf. Technical rept. no. 7 on Contract Nonr-222(62). June 59, 23p. 7 refs. AD-225 635.
Order from LC mi$2.70, ph$4.80 PB 146 415

Second order partial differential boundary problems are considered. The differential operator is required to be elliptic inside the domain G (not necessarily bounded) and its ellipticity $\sigma(s)$ is allowed to go to zero on the boundary (called singular points of G). The situation is generalized concerning non-self-adjoint operators and general boundary conditions. The operators are compared and the difference of their resolvents are studied by having the operators defined in the same space, $L^2(G)$. The operators are to be the same near the singular points as far as their boundary conditions and curves are concerned. Certain additional boundary curves Σ are added to ∂G in order to remain in $L^2(G)$. These curves may be contained entirely in the interior of G, or divide G in several disconnected subregions G_1, G_2 with different boundary conditions on the 2 sides of Σ. The differential operator is completely reduced by the decomposition $L^2(G) = L^2(G_1) \oplus L^2(G_2)$, where the functions of $L^2(G_1)$ are all zero on G_2, and similarly for $L^2(G_2)$. Proof is presented of the theorem which asserts that the difference of the 2 resolvents is a compact operator.

Columbia U., New York.
ON THE GEOMETRICAL SIGNIFICANCE OF THE MOMENTS OF ORDER STATISTICS AND OF DEVIATIONS OF ORDER STATISTICS FROM THE MEAN IN SAMPLES FROM GAUSSIAN POPULATIONS, by

Harold Ruben. Rept. on Contract Nonr-266(59). [1959] 16p. 4 refs. CU-9-59-Nonr-266(59)MS.
Order from LC mi$2.40, ph$3.30 PB 148 577

Let $E = E_{r|n}$ denote the rth largest observation in a random sample of n observations from a normal population with zero mean and unit variance. The distribution is investigated of $E_{r|n}$, the rth order statistic, and that of $E_{r\ n}-\bar{E}$, the deviation of the rth order statistic from the sample mean ($\bar{E}=\sum_{1}^{n} E_{r|n}/n$), from the point of view of the moment of these distributions. The characteristic function of $E_{r|n} - \bar{E}_{r|n}$ and of $E_{r|n}$ are obtained in a form which enables the geometrical significance of the moments of the 2 statistics to be assessed. Also shown is the fact that the sth moment of $E_{r|n} - \bar{E}$ is equal to the expectation of $n^{-1/2}{}^{s}H_s(E\sqrt{n})$ in the elementary probability law distribution, where $H_s(x)$ is the $(s+1)$th Tchebycheff-Hermite polynomial, normalized so that the coefficient x^s is unity.

Columbia U., New York.
THE RATE OF INCREASE OF THE SEQUENCE OF MAXIMA, by Herbert Robbins. Rept. on Contract Nonr-266(59). [1959] 6p. CU-3-59-Nonr-266(59)MS; AD-216 577.
Order from LC mi$1.80, ph$1.80 PB 146 414

Computer Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
RUNGE-KUTTA-GILL SOLUTION OF FIRST-ORDER DIFFERENTIAL EQUATIONS, by Alexander Edwards. Rept. on Contract DA 20-089-ORD-39246. 20 Apr 60, 19p. 3 refs. Rept. no. RR-23.
Order from LC mi$2.40, ph$3.30 PB 148 522

This report presents an extension for use with Purdue University's Compiler II. The extension solves a system of first-order differential equations of the form $dx_i/dt = f_i(x_i, t)$ using the Runge-Kutta Method as developed by Dr. Stanley Gill, (Cambridge Philosophical Society Proc. 1951, v. 47, p. 96-108). The extension as written is used with Burrough's Datatron 205 Digital Computer with the automatic floating-point unit, Model 360. The program is written in machine language. The approximate running time per solution is calculated by the expression: $T_{\Delta t} = (.34 + .6n) + 4t_f$ where $T_{\Delta t}$ = time in seconds for each interval Δt, n = number of equations and t_f is the time required to evaluate the functions $f(x_i)$. The accuracy is of the order $(\Delta t)^5 x_i$. (Author)

Connecticut U. [Storrs]
ON ORTHONORMAL SERIES AND DENSITY OF INTEGERS, by Richard P. Gosselin. Rept. on Contract AF 49(638)608. May 60, 17p. 3 refs. AFOSR-TN-60-555.
Order from LC mi$2.40, ph$3.30 PB 148 402

This note considers the convergence implications of hypotheses on the coefficient sequence of orthonormal series of the type $\sum_{n\geq 1} (\log n)^b\ |a_n|^2 < \infty$, $0 \leq b < 2$. The results are stated in terms of the almost everywhere convergence of subsequences of the full sequence of partial sums whose indices satisfy specified density conditions. (Author)

Electronics Research Lab., Northeastern U., Boston, Mass.
A BIBLIOGRAPHY OF PUBLICATIONS IN THE THEORY OF GAMES, by H. Stephen Schloss. Scientific rept. no. 1, 1944-1959, Contract AF 19(604)4573. 23 Oct 59, 96p. 1474 refs. AFCRC-TN-59-797; AD-234 153.
Order from LC mi$5.40, ph$15.30 PB 146 648

This bibliography was compiled primarily by examining the issues of The Mathematical Reviews from 1944 to the present, Operations Research, Annals of Mathematical Statistics, existing bibliographies in works by J. C. C. McKinsey, D. Blackwell and M. A. Girshick, Abraham Wald, R. D. Luce and H. Raiffa, and the comprehensive listing in Contributions to the Theory of Games IV, Annals of Mathematics Studies, no. 40, Princeton University Press. Other entries were found during general reading in this field. While some articles are not readily available they have been included, since the titles will indicate the aspect of game theory in which the particular writer is interested.

Electronics Research Lab., Northeastern U., Boston, Mass.
A BIBLIOGRAPHY OF RECENT PUBLICATIONS IN QUEUING THEORY, by Samuel M. Giveen. Scientific rept. no. 2, 1955-1959, on Contract AF 19(604)4573. 15 Dec 59, 17p. 128 refs. AFCRC-TN-60-103; AD-234 152.
Order from LC mi$2.40, ph$3.30 PB 146 647

This bibliography is designed to cover the literature on queuing theory for the period from 1955 to 1959. The present bibliography is concerned basically with the mathematical theory of the subject, and articles involving applications have been included where they seem to have a direct bearing on the mathematical equations of the theory. Purely descriptive articles have in general been omitted.

[Illinois U., Urbana]
THE EASIER WARING PROBLEM IN ALGEBRAIC NUMBER FIELDS, by Rosemarie Margarete Stemmler. Thesis. Technical rept. on Contract Nonr-1834(18). 1959, 38p. 8 refs.
Order from LC mi$3.00, ph$6.30 PB 146 318

Contents:
Determination of v(2;K) for all algebraic number fields
Upper bounds for v(q;K) when q is an odd prime
Upper bounds for v(m;K) when m is composite
Existence of algebraic number fields K for which $v(m;K) < v(m)$
Relation of v(m;K) to g(m;K) in totally complex fields

Institute for Advanced Study, Princeton, N. J.
ASYMPTOTIC DECAY OF SOLUTIONS OF DIFFERENTIAL INEQUALITIES, by Paul J. Cohen and Milton Lees. Rept. on Contract AF 49(638)253. May 60, 18p. 2 refs. AFOSR-[TN]-60-568.
Order from LC mi$2.40, ph$3.30 PB 148 328

An investigation is made of the maximum rate of decay at infinity of solutions of certain differential inequalities. Two types of differential inequalities are considered: abstract differential inequalities in a Hilbert space and concrete parabolic differential inequalities. (Author)

Institute for Advanced Study, Princeton, N. J.
AN EXACT SEQUENCE IN DIFFERENTIAL TOPOLOGY, by Morris W. Hirsch. Rept. on Contract AF 49(638)253. May 60, 4p. 4 refs. AFOSR-[TN]-60-544.
Order from LC mi$1.80, ph$1.80 PB 148 326

An exact sequence... $\rightarrow \Gamma^n \rightarrow \theta^n \rightarrow \Lambda^n \rightarrow \Gamma^{n-1} \rightarrow \ldots$ is described, relating certain abelian groups of interest in differential topology. (Author)

Institute for Advanced Study, Princeton, N. J.
AN INITIAL VALUE PROBLEM FOR POSITIVE SYMMETRIC HYPERBOLIC SYSTEMS, by Milton Lees. Rept. on Contract AF 49(638)253. Dec 59, 13p. 3 refs. AFOSR [TN]-60-30; AD-232 920.
Order from LC mi$2.40, ph$3.30 PB 146 316

An initial value problem for a symmetric hyperbolic system of partial differential equations is investigated by the method of finite differences. The assumption is made that the matrices of the system are symmetric and positive-definite. The initial value problem posed is distinct from the Cauchy problem. The existence and uniqueness of a solution is proved for all sufficiently smooth data. An approximate numerical procedure is described.

Institute for Advanced Study, Princeton, N. J.
ON A COLORING PROBLEM, by E. Asplund and B. Grunbaum. Rept. on Contract AF 49(638)253. Dec 59, 12p. 2 refs. AFOSR [TN]-60-29; AD-232 951.
Order from LC mi$2.40, ph$3.30 PB 146 317

A problem, posed by A. Bielecki (Colloq. Math. 1:33, 1948) is solved by the following theorem: Each family of rectangles in the plane, with horizontal and vertical edges, and such that no 3 have a common point, may be decomposed into 6 subfamilies consisting of mutually disjoint recetangles. Some related problems and results are discussed. (Author)

Institute for Advanced Study, Princeton, N. J.
ON EMBEDDING DIFFERENTIABLE MANIFOLDS IN EUCLIDEAN SPACE, by Morris W. Hirsch. Rept. on Contract AF 49(638)253. May 60, 10p. 10 refs. AFOSR-[TN]-60-545.
Order from LC mi$1.80, ph$1.80 PB 148 327

Recent results on combinatorial manifolds are applied to obtain embedding theorems for differentiable manifolds. It is shown that if M is a differentiable n-manifold, M can be embedded in Euclidean q-space R^q, where (a) $q = 2n-1$ if M is non-closed; (b) $q = n+2$ if M is contractible and n is odd; (c) $q = n+1$ if M is contractible and n is even. Various other results are obtained by assuming special conditions, e.g. M is parallelizable, or M is highly connected. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
GREEN'S FUNCTIONS FOR MONATOMIC SIMPLE CUBIC LATTICES, by A. A. Maradudin, E. W. Montroll and others. Rept. on Contracts AF 18(600)1315 and AF 49(638)399. Nov 59, 34p. 28 refs. Technical note BN-188; AFOSR-TN-60-202; AD-234 104.
Order from LC mi$3.00, ph$6.30 PB 146 416

A tabulation to six significant figures of the Green's functions for monatomic simple cubic lattices which are defined by the integral $I(a,b,c;\alpha;\beta) = \frac{1}{\pi^3}\int_0^{\pi}\int_0^{\pi}\int_0^{\pi} \frac{\cos ax \cos by \cos cz}{(2+\alpha)\beta - \cos x - \cos y - \alpha\cos z}\,dx\,dy\,dz$ is presented for the following ranges of the parameters: $\mu = \beta^{-1} = 0.00(0.01)1.00$; $\alpha = 1, 2, 4, 8, 16$; and $0 \leq a^2 + b^2 + c^2 \leq 15$. The recurrence formula satisfied by this integral, closed form expressions for the integral for special values of the parameters, asymptotic expressions valid in different ranges of the parameters, and examples of the applications of these tables are presented. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
AN OPTIMAL POINCARE INEQUALITY FOR CONVEX DOMAINS, by L. E. Payne and H. F. Weinberger. Rept. on Contract AF 49(638)228. Feb 60, 15p. 6 refs. Technical note BN-193; AFOSR-TN-60-248; AD-233 371.
Order from LC mi$2.40, ph$3.30 PB 146 754

The second (first non-zero) eigenvalue μ_2 of the free membrane problem $\Delta v + \mu v = 0$ with $\partial v/\partial n = 0$ on the boundary for an n-dimensional convex domain of diameter D is shown to satisfy $\mu_2 \geq \pi^2 D^{-2}$. Equality is approached for a thin parallelepiped. (Author)

Institute of Mathematical Sciences, New York U., N.Y.
POTENTIALS WITH ZERO SCATTERING PHASE, by H. E. Moses and S. F. Tuan. Rept. on Contract AF 19(604)4555. Nov 58, 20p. 48 refs. Research rept. no. CX-36; AFCRC TN-58-636.
Order from LC mi$2.40, ph$3.30 PB 138 248

The Gelfand-Levitan equation is used to construct potentials which, for a given angular momentum, yield scattering phases which are identically zero for all energies. The technique used herein gives all such potentials which belong to the class of potentials for which f(k) is analytic in the lower half-plane.

Iowa State U., Iowa City.
TREATMENT ERRORS IN COMPARATIVE EXPERIMENTS, by George Zyskind and Oscar Kempthorne. Rept. on Contract AF 33(616)5599. Apr 60, 83p. 45 refs. WADC Technical note 59-19.
Order from OTS $2.25 PB 161 874

The present report investigates a representative number of alternative experimental schemes in which explicit allowance is made for the fact that application of intended amounts of treatments may be subject to error. It is shown how the question of treatments subject to error may structurally be incorporated into a broader overall approach to experimental designs. When certain sets of structural conditions are satisfied the expected values of mean squares in the analyses of variance tables have simple and easily specifiable forms. These conditions have been verified to hold in all of the examples discussed. If treatment errors are operative then repeated independent attempts at realizing the preassigned amounts of treatments are to be desired since without them partial or total confounding of treatment amounts and treatment errors will result. The presence of treatment errors tends to decrease the sensitivity of tests of significance for treatment effects. The presence of interactions involving treatment errors tends not only to further decrease the sensitivity of tests but also to introduce negative bias both into tests of significance for treatments and into the estimation of the treatment component of variation; but the presence of these interactions tends to overestimate the average variance of estimates of treatment differences. (Author)

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON THE FACTORIZATION OF TRINOMIALS OVER GF(2) by Solomon W. Golomb, Lloyd R. Welch, and Alfred Hales. Rept. on Contract DA 04-495-ORD-18. 14 July 59, 21p. 7 refs. Memo. no. 20-189; AD-225 598.
Order from LC mi$2.70, ph$4.80 PB 148 648

The factorization of trinomials over GF(2) is investigated, and tables of factors of trinomials through degree 45 are included. Up to degree 36, the trinomials are factored completely. Detailed information on the periods of the trinomials and their factors is presented. (Author)

Kansas U., Lawrence.
CHARACTERISTICS AND CAUCHY PROBLEM FOR NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS OF FIRST ORDER, by Jacek Szarski. Technical rept. no. 21 on Studies in Eigenvalue Problems, Contract Nonr-58304. 1959, 102p. 17 refs. AD-225 054.
Order from LC mi$5.70, ph$16.80 PB 148 173

The theory of Cauchy characteristics is investigated for the equation of the form: $z_x = f(x, y_1, \ldots, y_n, z, z_{y_1}, \ldots, z_{y_n})$. The Cauchy problem is also studied for z_x and for systems of equations of the form: $z^i_x = f^i(x, y_1, \ldots, y_n, z^1, \ldots, z^m, z^i_{y_1}, \ldots, z^i_{y_n})$, $z^i_{x_v} = p^{iv}(x_1, \ldots, x_p, z^1, \ldots, z^m)$, and $z^i_{x_v} = f^{iv}(x_1, \ldots, x_p, y_1, \ldots, y_n, z^1, \ldots, z^m, z^i_{y_1}, \ldots, z^i_{y_n})$, where $i = 1, 2, \ldots, m$ and $v = 1, 2, \ldots, p$. Partial differential inequalities of the first order are considered, and also the uniqueness of the solution of the Cauchy problem for z_x and for z^i_x. The classical theory of characteristic strips of first order is treated for z_x together with recent results obtained by A. Plis. Characteristic strips of second order are considered for z_x, and existence theorem are studied for z_x and z^i_x. Also considered are the uniqueness and existence theorems for p^{iv} and f^{iv}.

Kansas U., Lawrence.
THEORY OF BESSEL POTENTIALS. PART I, by N. Aronszajn and K. T. Smith. Technical rept. no. 22 on Studies in Eigenvalue Problems, Contract Nonr-58304. 1959, 120p. 27 refs. AD-226 343.
Order from LC mi$6.00, ph$18.30 PB 148 585

A basis is presented for a treatment of differential eigenvalue and boundary value problems. The general theory of functional spaces and functional completion previously developed is applied to special spaces which are of importance in the study of differential problems, especially of the elliptic type. Potentials are considered which are based on the kernels: $G_\alpha(x) = \frac{1}{2^{(n+\alpha-2)/2}\pi^{n/2}\Gamma(\frac{\alpha}{2})} K_{\frac{n-\alpha}{2}}$ times $(|x|)|x|^{(\alpha-n)/2}$, where $K_{(n-\alpha)/2}$ is the modified Besel function of the third kind. All corresponding potentials are called Bessel potentials of order α. The theory of potentials of order α in the whole space R^n is given. The classes of potentials P^α are considered in the subdomains of R^n (especially in bounded domains), and also on differentiable and Riemannian manifolds.

Liège U. (Belgium).
ASYMPTOTIC REPRESENTATION OF THE SPECTRAL FUNCTION OF SELF-ADJOINT ELLIPTIC OPERATORS OF THE SECOND ORDER WITH VARIABLE COEFFICIENTS, by F. J. Bureau. Technical (scientific) note no. 2 on Contract AF 61(052)86. Nov 59, 80p. 21 refs. AFOSR-TN-59-1182; AD-232 050.
Order from LC mi$4.50, ph$12.30 PB 146 716

Let $L_x \equiv a^{ij}(x)\frac{\partial 2}{\partial x^i \partial x^j} + b^i(x)\frac{\partial}{\partial x} + c(x)$, $(i, j = 1, \ldots, n)$ be a self-adjoint elliptic operator with analytic coefficients and $u_{tt} - L_x u = 0$ the totally hyperbolic equation associated with L_x. The connection between the elementary solutions of L_x and the hyperbolic equation is described. The solution of the Cauchy problem for the hyperbolic equation is written with classical symbols only. Then the asymptotic behavior is considered of the spectral function $\Theta(x, y; \lambda)$ of $L_x v + \lambda v = 0$, $x \in D$, and $v = 0$ on D, where λ a parameter, D a bounded simply connected domain of R^n with boundary D.

Maryland U., College Park.
CONTINUOUS DEPENDENCE AND UNIQUENESS IN CAUCHY'S PROBLEM FOR FIRST ORDER, NONLINEAR, PARTIAL DIFFERENTIAL EQUATIONS,

by Avron Douglis. Rept. on Contract AF 49(638)590. June 60, 16p. 9 refs. AFOSR-TN-60-572.
Order from LC mi$2.40, ph$3.30 PB 148 363

The C' solutions of a non-linear, first order, sufficiently regular, partial differential equation $U_t + F(x, t, U, U_x) = 0$ are known to depend continuously upon their initial data. Continuous dependence for solutions not of class C' is considered in this paper. (Author)

Maryland U., College Park.
ON THE UNIQUENESS OF GENERALIZED SOLUTIONS OF FIRST ORDER, QUASILINEAR PARTIAL DIFFERENTIAL EQUATIONS, by Avron Douglas. Rept. on Contract AF 49(638)590. June 60, 8p. AFOSR-TN-60-571.
Order from LC mi$1.80, ph$1.80 PB 148 362

A simple proof is presented of the theorem of Oleinik that the generalized solutions of partial differential equations of the form $u_t + (F(x, t, u))_x + G(x, t, u) = 0$ are uniquely determined by their Cauchy data. (Author)

Maryland U., College Park.
AN ORDERING PRINCIPLE FOR CONSERVATION LAWS IN TWO VARIABLES, by Avron Douglis. Rept. on Contract AF 49(638)590. June 60, 7p. 2 refs. AFOSR-TN-60-570; AD-238 073
Order from LC mi$1.80, ph$1.80 PB 148 361

If $F_{uu}(x, t, u) \geq 0$, the generalized solutions of the conservation law $u_t + (F(x, t, u))_x = 0$ are partially ordered like their initial data. (Author)

Massachusetts Inst. of Tech., Cambridge.
SINGULAR INTEGRAL EQUATIONS, BOUNDARY VALUE PROBLEMS AND THE RIEMANN-ROCH THEOREM, by Walter Koppelman. Technical note on Contract AF 49(638)42. [1959] 46p. 24 refs. AFOSR Technical note 60-587.
Order from LC mi$3.30, ph$7.80 PB 148 538

Naval Weapons Lab., Dahlgren, Va.
ON THE STABILITY OF UNIQUELY DEFINED INTEGRALS OF PARTIAL DIFFERENTIAL EQUATIONS, by E. W. Schwiderski. 13 May 60, 25p. 14 refs. NWL rept. no. 1700.
Order from LC mi$2.70, ph$4.80 PB 148 655

The Hadamard definition of the above is reformulated so that the new stability concept takes account of the intrinsic properties of the uniquely defined integral. A mathematical and physical justification of the new concept is given. A definition of the stability of constructive methods is given in general and discussed in detail by means of finite difference equations. (Author)

Nebraska U., Lincoln.
A STUDY OF THE BOUNDARY VALUE PROBLEM FOR NONLINEAR SECOND ORDER ORDINARY DIFFERENTIAL EQUATIONS, by Lloyd Jackson. Rept. on Contract AF 49(638)506. 15 Apr 60, 42p. 10 refs. AFOSR-[TN]-60-491.
Order from LC mi$3.30, ph$7.80 PB 148 413

The boundary valued problem for the equation $y'' = f(x, y, y')$ is studied by subfunction methods. A generalized solution is obtained. (Author)

Northwestern U., Evanston, Ill.
AN INTEGRAL TRANSFORM RELATED TO THE HILBERT TRANSFORM, by Richard R. Goldberg. Rept. on Contract AF 49(638)383. Mar 60, 6p. 2 refs. AFOSR TN-60-197; AD-233 956.
Order from LC mi$1.80, ph$1.80 PB 146 418

The following basic results are established concerning the transform $f^*(x) = \frac{1}{\pi}\int_0^\infty \frac{f(x+t) - f(x-t)}{t} \cdot \frac{\sin t}{t}\, dt$ for arbitrary $f \in L^2$: an inversion formula, an explicit expression for f^* in terms of the Hilbert transform of f, an explicit expression for the Hiblert transform of f in terms of f^*, and an expression for f^{**} in terms of f. (Author)

Nortnwestern U., Evanston, Ill.
WATSON TRANSFORMS ON GROUPS, by Richard R. Goldberg. Rept. on Contract AF 49(638)383. Mar 60, 7p. 1 ref. AFOSR TN-60-198; AD-233 957.
Order from LC mi$1.80, ph$1.80 PB 146 417

The theory of general transforms of $L^2(0, \infty)$ is extended to groups. If G is any locally compact abelian group then, on $L^2(G)$, a set of integral transforms is constructed each of which gives rise to a unitary transformation on $L^2(G)$. With appropriate specialization these integral transforms become the classical Watson transforms. (Author) (See also PB 146 418)

Purdue Research Foundation, Lafayette, Ind.
A NOTE ON NON-NEGATIVE MATRICES, by C. R. Putnam. Technical note no. 10 on Commutators on a Hilbert Space, Contract AF 18(603)139. Mar 60, 7p. 6 refs. PRF 1421; AFOSR-TN-59-692; AD-233 512.
Order from LC mi$1.80, ph$1.80 PB 146 377

Results on non-negative matrices previously obtained are extended. (Author)

Purdue Research Foundation, Lafayette, Ind.
A NOTE ON TOEPLITZ MATRICES AND UNITARY EQUIVALENCE, by C. R. Putnam. Technical note no. 11 on Commutators on a Hilbert Space, Contract AF 18(603)139. Mar 60, 6p. 9 refs. PRF 1421; AFOSR-TN-60-28; AD-233 511.
Order from LC mi$1.80, ph$1.80 PB 146 362

A generalization is obtained of a condition assuring the unitary equivalence of a Toeplitz matrix (c_{j-k}) to a certain function of the matrix belonging to the quadratic form of $2\sum_{1}^{\infty} x_n x_{n+1}$. (Author)

RIAS, Baltimore, Md.
A DISCUSSION OF DIFFERENTIAL EQUATIONS ON PRODUCT SPACES, by Jack K. Hale and Arnold Stokes. Rept. on Contract AF 49(638)382. Jan 60, 21p. 8 refs. Technical rept. 60-3; AFOSR-TN-59-1283; AD-233 044.
Order from LC mi$2.70, ph$4.80 PB 146 721

RIAS, Baltimore, Md.
ON CERTAIN NON-LINEAR OPERATORS AND PARTIAL DIFFERENTIAL EQUATIONS, by Gertrude I. Heller (Johns Hopkins U.). May 60, 83p. 3 refs. Technical rept. 60-14; AFOSR-TN-60-474.
Order from LC mi$4.80, ph$13.80 PB 148 659

RIAS, Baltimore, Md.
ON THE METHOD OF KRYLOV-BOGOLIUBOV-MITROPOLSKI FOR THE EXISTENCE OF INTEGRAL MANIFOLDS OF PERTURBED DIFFERENTIAL SYSTEMS, by J. K. Hale. Rept. on Contract AF 49(638)382. Jan 60, 19p. 15 refs. Technical rept. 60-1; AFOSR-TN-59-1293; AD-233 806.
Order from LC mi$2.40, ph$3.30 PB 146 365

Some important results of N. Bogoliubov and Y. Mitropolski [Asymptotic methods in the theory of nonlinear oscillations, (Russian) Moscow (1955) Rev. 1958] on the existence of integral manifolds of differential systems are discussed. The results are stated in terms of a particular problem, but the proofs of these results apply to a much larger variety of questions. Only those generalizations are mentioned which are essential to make an association with some recent results of various authors in this country, and postpone a more complete discussion of the generalizations to a later paper. (Author)

RIAS, Baltimore, Md.
PERIODIC ORBITS ON TWO MANIFOLDS, by Bruce L. Reinhart. Rept. on Contract AF 49(638)382. Jan 60, 13p. 3 refs. Technical rept. 60-2; AFOSR-TN-59-1282; AD-233 043.
Order from LC mi$2.40, ph$3.30 PB 146 722

Given any vector field V on an oriented 2 manifold, an integer I(V, C), defined by an integral, is assigned to any curve C. On the other hand, to any C with everywhere nonzero tangent vector, an integer called the winding number of C can be assigned. By comparing these 2 integers, necessary conditions for C to be a periodic orbit may be obtained. These ideas are discussed and applied to a problem on the solid torus. A certain class of vector field is shown to always admit a periodic orbit.

RIAS, Baltimore, Md.
SOME EXTENSIONS OF LIAPUNOV'S SECOND METHOD, by J. P. LaSalle. Rept. on Contract AF 49(638)382. [1960] 38p. 8 refs. Technical rept. 60-5; AFOSR-TN-60-22; AD-233 805.
Order from LC mi$3.00, ph$6.30 PB 146 363

In studying the stability of a system it is never completely satisfactory to know only that an equilibrium state is asymptotically stable. As a practical matter, it is necessary to have some idea of the size of the perturbations the system can undergo and still return to the equilibrium state. It is never possible to do this by examining only the linear approximation. The effect of the nonlinearities must be taken into account. Liapunov's second method provides a means of doing this. Mathematical theorems underlying methods for determining the region of asymptotic stability are given, and the methods are illustrated by a number of examples. (Author)

Statistical Lab., Case Inst. of Tech., Cleveland, Ohio.
ORDER STATISTICS AND ESTIMATORS FOR THE WEIBULL DISTRIBUTION, by F. C. Leone, Y. H. Rutenberg, and C. W. Topp. Rept. on Contract AF 49(638)361. Mar 60, 25p. 14 refs. AFOSR-TN-60-489.
Order from LC mi$2.70, ph$4.80 PB 147 747

The first part of this paper is devoted to an expository discussion of the properties of the generalized Weibull Distribution $F(x) = 1 - \exp[-(x-a)/b)^c]$. This is followed by a discussion of the order statistics from the distribution. In the second part, properties of the distributions of the smallest and largest order statistics are studied. The third part deals with problems of estimation of parameters.

Syracuse U., N. Y.
THE DIFFERENTIABILITY OF TRANSITION FUNCTIONS, by Donald Ornstein. Research rept. 24 on Contract AF 49(638)265. Oct 59, 9p. 4 refs. AFOSR-TN-1265; AD-233 105.
Order from LC mi$1.80, ph$1.80 PB 146 732

Syracuse U., N. Y.
A GENERAL ERGODIC THEOREM, by R. V. Chacon and D. S. Orstein. Research rept. 26 on Contract AF 49(638)265. Oct 59, 13p. 6 refs. AFOSR-TN-59-1267; AD-233 107.
Order from LC mi$2.40, ph$3.30 PB 146 734

The following theorem is proved: Let T be a positive linear operator on L_1 of a positive measure space (S, G, μ) and let T have L_1 norm less than or equal to one. Then if f and p are functions in L_1 and if p is non-negative, the limit $\lim_{n\to\infty} \frac{\sum_{k=0}^{n} T^k f}{\sum_{k=0}^{n} T^k p}$ exists and is finite almost everywhere on the set $A = \{s: T^k p > 0$ for some $k \geq 0\}$.

Syracuse U., N. Y.
ON LAST EXIT TIMES, by K. L. Chung. Research rept. 23 on Contract AF 49(638)265. Oct 59, 19p. 5 refs. AFOSR-TN-59-1264; AD-233 092.
Order from LC mi$2.40, ph$3.30 PB 146 730

The last exit time from a given state before a given time is studied. Its properties related to the analytic properties of the transition matrix and the reversed nonstationary chains are also discussed. (Author) (See also AD-233 105)

Syracuse U., N. Y.
ON THE ANALYTIC STRUCTURE OF MARKOV PROCESSES, by W. B. Jurkat. Research rept. 25 on Contract AF 49(638)265. Oct 59, 7p. AFOSR-TN-59-1266; AD-233 106.
Order from LC mi$1.80, ph$1.80 PB 146 733

A general solution to the backward Kolmogorov equation is constructed under the hypothesis of a finite number of exits. (Author)

Syracuse U., N. Y.
ON THE ANALYTIC STRUCTURE OF SEMI-GROUPS OF POSITIVE MATRICES, by W. B. Jurkat. Research rept. 22 on Contract AF 49(638)265. Oct 59, 33p. 12 refs. AFOSR-TN-59-1263; AD-233 135.
Order from LC mi$3.00, ph$6.30 PB 146 731

The dual of the first entrance formula is obtained from which general differentiability properties are deduced. (Author)

Syracuse U., N. Y.
ON THE MAXIMUM NUMBER OF DEFICIENT VALUES OF CERTAIN CLASSES OF FUNCTIONS, by Albert Edrei and Wolfgang H. J. Fuchs (Cornell U.). Rept. on Contract AF 49(638)571. Apr 60, 40p. 15 refs. AFOSR-TN-60-402.
Order from LC mi$3.00, ph$6.30 PB 148 414

Let f(z) be meromorphic and let m(r, f) and T(r, f) be the quantities which play a fundamental role in Nevanlinna's theory. The authors show that

$$\liminf_{r \to \infty} \frac{m\left(r, \frac{f}{f'}\right)}{T(r,f)} = 0$$

provided f(z) has its zeros and poles distributed on a finite number of radii passing through the origin and its order is either infinite or finite, but not too small.

Virginia Agricultural Experiment Station, Blacksburg.
BIBLIOGRAPHY ON SEQUENTIAL ANALYSIS, by J. Edward Jackson. Technical rept. no. 6 on Development of Statistical Methods for Experimental Designs in Quality Control and Surveillance Testing, Contract Nonr-2352(01). May 59, 51p. 313 refs.
Order from LC mi$3.60, ph$9.30 PB 146 350

The references are listed alphabetically by author and also broken down into fourteen subject categories.

Virginia Agricultural Experiment Station, Blacksburg.
THE COMPARISON OF THE SENSITIVITIES OF SIMILAR EXPERIMENTS: MODEL II OF THE ANALYSIS OF VARIANCE, by D. E. W. Schumann and R. A. Bradley. Technical rept. no. 3 on Development of Statistical Methods for Experimental Designs in Quality Control and Surveillance Testing, Contract Nonr-2352(01). Nov 58, 19p. 3 refs. AD-212 145.
Order from LC mi$2.40, ph$3.30 PB 146 473

Comparisons of the sensitivities of experiments are considered based on the Model II of the analysis of variance (with random effects). Extended and new tables are included. (Author)

Virginia Agricultural Experiment Station, Blacksburg.
INTRA- AND INTER-BLOCK ANALYSIS FOR FACTORIALS IN INCOMPLETE BLOCK DESIGNS, by R. A. Bradley, R. E. Walpole, and C. Y. Kramer. Technical rept. no. 7 (Final) on The Development of Statistical Methods for Experimental Designs in Quality Control and Surveillance Testing, Contract Nonr-2352(01). June 59, 42p. 22 refs. AD-219 182.
Order from LC mi$3.30, ph$7.80 PB 146 406

An extension was made on the recent work of Kramer and Bradley [Ann. Math. Stat. 28:349-361, 1957] to the use of factorials in the several suitable classes of two-associate class, partially balanced incomplete block (p. b. i. b.) designs not previously considered. A second objective is to complete the earlier work through utilization of inter-block information in combined intra- and inter-block estimators. Considered specifically are the recovery of inter-block information in group divisible designs, both intra- and inter-block analyses for Latin-square, sub-type L_2 designs and Latin-square, sub-type L_3 designs, and discuss other p. b. i. b. designs with two associate classes. In each situation tests of significance and estimators of factorial effects are obtained along with efficiencies of contrasts. (Author)

Washington U., Seattle.
FINAL REPT. ON CONTRACT NONR-477(22). [1959] 4p.
Order from LC mi$1.80, ph$1.80 PB 148 139

One problem which was solved concerned topological properties of Banach spaces under their weak topologies. Some metrization theorems have been proved which greatly simplify some known proofs for metrization theorems for compact spaces.

Washington U., Seattle. Div. of Counseling and Testing Services.
TRIANGULAR FACTORING OF A SYMMETRIC MATRIX, AN IBM TYPE 650 PROGRAM, by Harold Burk and Glenn E. Roudabush. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C4). Sep 59, 7p. 2 refs. AD-229 936.
Order from LC mi$1.80, ph$1.80 PB 148 869

Washington U., Seattle. Div. of Counseling and Testing Services.
A PROGRAM FOR CALCULATING RAW SCORE REGRESSION WEIGHTS, MULTIPLE CORRELATION COEFFICIENTS, AND AVERAGE SQUARED ERROR OF PREDICTION ON THE IBM TYPE 650, by Dennis E. Hamilton and Glenn E. Roudabush. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C4). July 59, 21p. 6 refs. AD-229 937.
Order from LC mi$2.40, ph$4.80 PB 147 273

A program was constructed to provide certain basic statistical parameters associated with the classical multivariate linear regression model. Treating standard regression weights derived by any of several methods, the program supplies 2 measures of comparison and effectiveness: (1) the multiple correlation coefficient and (2) the average squared error of prediction. In addition, raw score regression weights, or b weights, are provided which may be utilized in predicting the dependent (criterion) variable of the model. The additive constant of the raw score model is also calculated. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
A STOCHASTIC METHOD OF SOLVING PARTIAL DIFFERENTIAL EQUATIONS USING AN ELECTRONIC ANALOG COMPUTER, by Kuei Chuang, Louis F. Kazda, and Thomas Windeknecht. Rept. on Project Michigan, Contract DA 36-039-sc-78801. June 60, 53p. 8 refs. 2900-91-T.
Order from LC mi$3.60, ph$9.30 PB 148 524

This report presents an analog-computer method for solving a general class of two-dimensional boundary-value problems in which only a small number of operational amplifiers is required. The method simulates the boundary-value problem under consideration as a stochastic model by a technique commonly designated the "Monte Carlo method." In this case, the stochastic method becomes a tool for the numerical analysis of the partial differential equation. Although the Monte Carlo method of digital-computer solution of partial differential equations has been extensively studied, its application to the analog computer is believed to be new.

Wisconsin U., Madison.
ON SOME BANACH SPACE OF ANALYTIC FUNCTIONS OF SEVERAL COMPLEX VARIABLES, by D. B. Lowdenslager. Preliminary rept. on Contract N7onr-285(07). [1959] 12p. 13 refs. AD-225 105.
Order from LC mi$2.40, ph$3.30 PB 148 875

Computing Devices

Air Force Cambridge Research Center, Bedford, Mass.
INTERPRETIVE ROUTINE FOR QUADRUPLE-PRECISION NUMBERS, by Murray E. Sherry. Mar 59 9p. Cambridge Computer Series no. 3; AFCRC-TN-59-155; AD-233 828.
Order from LC mi$1.80, ph$1.80 PB 146 331

For programming purposes, the Cambridge computer contains 2000 registers numbered 0000 to 1999, each of which will accomodate a 10 decimal digit number with sign. Registers 0000 to 0099 and 0900 to 1999 are used for the quadruple-precision routine. Registers 0100 to 0899 are for general programming use. The quadruple-precision routine enables the programmer to deal with numbers containing 37 decimal digits. The exponent of the number is the written exponent (mod 500). Numbers are stored in memory in 4 successive registers. A number is referred to by the location of the first register. The correct sign of the number must be carried in all 4 memory locations. (Author)

Computer Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
DIGITAL COMPUTER PROGRAM FOR FUEL CONSUMPTION: TRACKED VECHILES (BATTLEFIELD DAY AND NORMAL CONVOY), by Mary Archambault. Rept. on Contract DA 20-089-ORD-39246. May 60, 42p. Rept. no. RR-24.
Order from LC mi$3.30, ph$7.80 PB 148 759

This report presents a Digital Computer program for determining fuel consumption of track vehicles under Battlefield Day and Normal Convoy conditions, together with the necessary fuel tank capacity requirement and the radius of action limits for convoy, highway, secondary road, and cross country operation. (Author)

Digital Computer Lab., U. of Illinois, Urbana.
THE DECISION AND SYNTHESIS PROBLEMS IN SEMI-MODULAR SWITCHING THEORY, by James H. Shelly. Doctoral thesis. Rept. on Contract Nonr-1834(27). 20 May 59, 98p. 41 refs. Rept. no. 88; AD-219 323.
Order from LC mi$5.40, ph$15.30 PB 146 603

The decision and synthesis procedures are investigated for semi-modular circuits, a sub-class of asynchronous switching circuits. This includes a characterization of such circuits by means of properties of a set of numerical vectors and an application of these results to the synthesis problem. The synthesis procedure studied assumes that the description of the circuit to be synthesized is in the form of a set L of n-dimensional vectors of non-negative integers. The object of the synthesis is to produce a semi-modular circuits C whose C-state lattice coincides with L. Another aspect of the synthesis problem is that the description of the circuit is often in a flow chart form, rather than as a lattice of vectors. (Author)

Electronics Research Lab., U. of California, Berkeley.
AN OPTIMAL STRATEGY FOR A SATURATING SAMPLE-DATA SYSTEM, by Charles A. Desoer and Jack Wing. Rept. on Contract AF 18(600)1521. 15 Dec 59, 42p. 6 refs. Series no. 60, issue no. 262; AFOSR-TN-60-67; AD-233 739.
Order from LC mi$3.30, ph$7.80 PB 146 361

The problem of finding, proving, and implementing the optimal strategy for the sampled-data servo is discussed. A second-order linear servomechanism is considered. The optimal control signal for this system may be obtained by a simple method using standard analog computer techniques. A formulation is presented of the problem that requires the minimum number of parameters. The set of all possible initial states is partitioned into sets, R_N, in terms of the minimum number of sampling periods required to reach equilibrium. Theorems are presented which establish the exact shape of these sets. The optimal strategy is shown to be unique for special initial states. The optimality of the proposed strategy is established and implemented. The relationship between the optimal strategy for the sampled system and the optimal relay solution for the corresponding continuous system is discussed.

Institut d'Optique, Paris (France).
DESIGN OF A COMPUTER ESPECIALLY ADAPTED TO THE STUDY OF THE PROPERTIES OF THIN FILMS. Final technical rept. no. 1, 1 Mar 59-1 Mar 60, on Contract DA 91-591-euc-1080. [1960] 33p. AD-235 138.
Order from LC mi$3.00, ph$6.30 PB 147 252

A study is summarized of the design of the logical scheme of a digital computer especially adapted to the study of the properties of thin films. The study of thin films leads to operations which, from the computer point of view, were classified under 2 categories: (1) elementary operations such as algebraic sums and multiplications; and (2) interpretive operations as division, square root, sine, cosine, and exponential functions. The following special features for optical calculations were developed: (1) a double address system which rules the connections between the memory and the arithmetic unit; (2) a novel complement-type of performing algebraic sums within the arithmetic unit; (3) a novel conversion from fixed, point to floating-point notation, to operate automatically when required within a running program; and (4) jump and return transfers to and from subroutines.

International Telemeter Corp., Los Angeles, Calif.
CONVENTIONS REGARDING LOGICAL ARRANGEMENT OF INFORMATION ON DISC. Technical rept. no. 13 [on Contract AF 30(602)1566] 20 Oct 57, 13p. RADC-TN-57-384; AD-131 380.
Order from LC mi$2.40, ph$3.30 PB 146 723

Consideration was given to the following: (1) the representation and ordering of information, (2) punched paper tape, (3) flexowriter punching, (4) the tape-to-tape unit, (5) the tape-to-film unit, (6) the film-to disk unit, and (7) the desk reader unit.

Michigan U. Research Inst., Ann Arbor.
APPLICATION OF LOGIC TO THE DESIGN OF COMPUTING MACHINES, by A. W. Burks, H. Wang, and J. Holland. Final rept. on Contract AF 18(603)72. Aug 59, 13p. 2512-4-F; AFOSR-TR-59-106; AD-226 604.
Order from LC mi$2.40, ph$3.30 PB 146 390

The results previously obtained on fixed automata are summarized. Results obtained on growing automata are reviewed. A universal computer is described which is capable of simultaneously executing an arbitrary number of sub-programs. The number of such sub-programs vary as a function of time under program control or as directed by input to the computer. Three features of the computer are: (1) the structure of the computer is a 2-dimensional modular (or iterative) network; (2) each sub-program is spatially organized, thus facilitating the simulation of highly parallel systems having many points or parts; and (3) the computer's structure and behavior can, with simple generalizations, be formulated so as to make it a useful abstract tool for investigating problems in automata theory. (Author)

New York U. Coll. of Engineering, N. Y.
SAMPLED-DATA CONTROL SYSTEMS WITH TWO DIGITAL PROCESSING UNITS, by James C. Hung. Rept. on Contract AF 49(638)586. Jan 60, 29p. 8 refs. Technical rept. 400-2; AFOSR-TN-60-18; AD-232 461.
Order from LC mi$2.70, ph$4.80 PB 146 714

The theory and the procedure are presented for designing the sampled-data control system having a digital processing unit in the forward line and another digital processing unit in the feedback loop to response to inputs as well as to neutralize the disturbance of a deadbeat system. The examples using the proposed design procedure are given, and their root-loci are plotted and discussed. (Author)

MECHANICS

Stanford U., Calif.
A THEORY OF SMALL DEFORMATIONS OF SOLID BODIES, by J. F. Besseling. Rept. on Contract AF 49(638)223. Feb 59, 112p. 42 refs. SUDAER no. 84; AFOSR-TN-59-605; AD-217 172.
Order from LC mi$6.00, ph$18.30 PB 148 754

An attempt is made to present a theory that is capable of giving a mathematical description of the following phenomena observed in the deformation and heating of solid bodies: thermal stresses, thermoelastic damping of vibrations, dynamic and static moduli, Bauschinger effect and other anisotropic hardening phenomena in plastic deformation, primary creep preceding the secondary stage of steady creep under constant stress, creep recovery and stress relaxation. The variational principles of thermoelasticity, creep and of the theories of plasticity are all derived from one thermodynamic variational principle which is formulated with the aid of the entropy displacement field introduced by Biot. Thermoelastic damping of bending vibrations of beams and creep damping of pure shear vibrations are considered in some detail. (Author)

Technion Research and Development Foundation, Ltd. (Israel).
THE EFFECT OF AXIAL CONSTRAINT ON THE INSTABILITY OF THIN CIRCULAR CYLINDRICAL SHELLS UNDER EXTERNAL PRESSURE, by Josef

Singer. Technical note no. 1 on Contract AF 61(052)123. Sep 59, 21p. 9 refs. AFOSR-TN-60-165; AD-232 083.
Order from LC mi$2.70, ph$4.80 PB 146 711

The effect of axial elastic restraint on the instability of a circular cylindrical shell under hydrostatic pressure or under uniform lateral pressure, is analysed by a Rayleigh Ritz approach. For the case of hydrostatic pressure the effect is calculated for a wide range of parameters and design curves are presented for the percentage increase in critical pressure. The analysis is carried out for restraints which are active from the beginning of loading and for such which come into action only at the onset of buckling, and the difference between these 2 types of restraint is shown to be very small. (Author)

Yale U., New Haven, Conn.
POINTED VERTICES IN THE YIELD SURFACE, by Aris Phillips. Technical rept. no. 7 on Contract Nonr-609(12). Sep 59, 26p. 9 refs. AD-228 393.
Order from LC mi$2.70, ph$4.80 PB 148 568

Tests were described in which thin-walled tubes of annealed commercially pure aluminum (2S-0) were loaded under combined tension and torsion. The paths of loading in those tests had, at regular intervals, very abrupt changes in the direction of the stress increment vector. These abrupt changes in the direction of the stress increment vector were found to produce small abrupt changes in the direction of the plastic strain increment vector. Such results imply the existence of pointed vertices in the yield surface and specifically imply that the loading path carries a pointed vertex with it. The evaluation of these tests is continued. The loading path is shown conclusively to carry a pointed vertex with it. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
SIMPLIFIED VIBRATION ANALYSIS OF ELASTIC SANDWICH PLATES, by Yi-Yuan Yu. Technical note no. 5 on Contract AF 49(638)453. Aug 59, 25p. 6 refs. AFOSR-TN-59-1082; AD-234 221.
Order from LC mi$2.40, ph$4.80 PB 146 639

In a sequence of 3 recent papers by the author, a new flexural theory of elastic sandwich plates was developed, and, on the basis of the theory, the flexural vibration of sandwich plates was analyzed. The theory is good for a very wide frequency range that is of practical interest, but vibration analysis on the basis of the theory will in general be complicated due to the high order of the equations. For low frequency ranges simplified treatment of the vibration problem becomes possible and is discussed. Simpler equations of motion of sandwich plates are introduced, and their accuracy is determined by comparing with the previous more complete equations. (Author)

Stanford U., Calif.
BUCKLING OF A THIN CIRCULAR CYLINDRICAL SHELL HEATED ALONG AN AXIAL STRIP, by D. W. Hill. Rept. on Contract AF 49(638)223. Dec 59, 99p. 19 refs. SUDAER no. 88; AFOSR-TN-59-1250.
Order from LC mi$5.40, ph$15.30 PB 148 504

The problem considered is that of a thin circular cylindrical shell heated along a narrow strip in the axial direction. The restraint of the cooler portion causes compressive axial stresses in the heated strip, and if these stresses are sufficient in magnitude the cylinder can buckle into waves along the heated strip. The problem is solved using the Ritz method, assuming for the displacements Fourier series modified by a shape factor chosen to magnify the solution in the vicinity of the heated strip. The convergence rate of the solution is greatly increased by the shape factor. In the analysis of the stress distribution, the cylinder is assumed to be simply supported on its ends so that the radial and circumferential displacements there are the range $0 \leqslant E\alpha V/\sigma_y \leqslant 5$ and the particular case $E\alpha V/\sigma_y \to \infty$. Detailed solutions are given for $E\alpha V/\sigma_y = 1, 2, 3, 4, 5$ and ∞. (Author)

Stanford U., Calif.
IDEALIZED COLUMNS, by N. J. Hoff. Rept. on Contract AF 49(638)223. Aug 58, 27p. 18 refs. SUDAER no. 82; AFOSR-TN-60-381.
Order from LC mi$2.70, ph$4.80 PB 148 752

Graphic methods and simple analytic formulas are presented for the determination of the quantities of greatest interest in the elastic, plastic and creep buckling of columns. The results are rigorously valid only for columns of idealized I section but they represent good approximations in the case of extruded and built up sections. (Author)

Stanford U., Calif.
MECHANICS APPLIED TO CREEP TESTING, by N. J. Hoff. Rept. on Contract AF 49(638)223. Dec 58, 88p. 49 refs. SUDAER no. 83; AFOSR-TN-59-39.
Order from LC mi$4.80, ph$13.80 PB 148 753

The non-linearity of the creep laws governing the inelastic deformations of structural materials at high temperatures makes it difficult for the engineer to interpret correctly the results of creep tests and to predict the effect of small changes in the parameters upon the strain rates. It is the purpose of this paper to present information on the basis of which these tasks can be performed a little more easily. The causes of the large scatter in the results of creep tests, the effect of creep on the stress distribution, the interaction between linear elasticity and non-linear creep, and the difficulties encountered in the determination of the primary phase of creep are discussed with the aid of the principles of applied mechanics. The paper closes with a brief survey of instability phenomena. (Author)

Stanford U., Calif.
THE STRESSES IN AN ELASTO-PLASTIC BAR SUBJECTED TO A SUDDEN CHANGE OF SURFACE TEMPERATURE, by E. W. Parkes. Rept. on Contract AF 49(638)223. Jan 60, 21p. 8 refs. SUDAER no. 89p AFOSR-TN-60-321
Order from LC mi$2.70, ph$4.80 PB 148 505

An analysis is given for the stress history in an elasto-plastic bar subjected to a sudden change of surface temperature. The type of behavior is found

to depend on the ratio of thermal strain (αV) to yield strain (σ_y/E). For $E\alpha V/\sigma_y < 1$, the stresses are entirely elastic. For $1 < E\alpha V/\sigma_y < 2.04$ there are two transient zones of compressive yielding. For $2.04 < E\alpha V/\sigma_y < 4.4$ there are two transient zones of compressive yielding and two enduring zones of tensile yielding. For $E\alpha V/\sigma_y > 4.4$ there are two transient zones of compressive yielding, one transient zone of tensile yielding, and two enduring zones fo tensile yielding. The investigation is restricted to zero, but the axial displacements and end rotations are not restricted. In the calculation of the stability, a simplified thermal stress distribution is assumed which is the one prevailing in the middle of the cylinder. The stresses are assumed to vary around the circumference but to be constant in the axial direction. Expressions are given relating the physical parameters of the cylinder, the temperature distribution, and the magnitude of the temperature causing buckling.

Stanford U., Calif.
SUMMARY OF RESEARCH IN ELASTICITY, ELASTIC STABILITY, ELASTIC WAVE PROPAGATION 1948-1958, by J. N. Goodier. Rept. on Contract Nonr-225(29). 31 Aug 59, 39p. 29 refs. Div. of Engineering Mechanics technical rept. no. 121.
Order from LC mi$3.00, ph$6.30 PB 148 183

Contents:
Investigations in linear and non-linear elastic stress and deformation, analytical and experimental
Investigations in elastic buckling of bars, plates and sandwich panels, analytical and experimental
Investigations in elastic wave propagation, analytical and experimental
Other investigations

Stanford U., Calif.
A SURVEY OF THE THEORIES OF CREEP BUCKLING, by N. J. Hoff. Rept. on Contract AF 49(638)223. June 58, 66p. 50 refs. SUDAER no. 80; AFOSR-TN-60-382.
Order from LC mi$3.90, ph$10.80 PB 148 751

A survey is presented of the theories of buckling of structural elements whose materials is subject to creep deformations. Two fundamentally different approaches to the solution of the buckling problem are discussed. In one, the structural element is assumed to be perfect and perfectly centered under the loads and buckling is initiated by a disturbance in the configuration. In the second, the creep deformations begin in consequence of the deviation of the unloaded centerline or median plane of the structural element from the line of load application. In both cases the element has a finite lifetime. A critical time of creep buckling is defined beyond which the element cannot be used to carry the prescribed loads. (Author)

Stanford U., Calif.
A THEORY OF ELASTIC, PLASTIC, AND CREEP DEFORMATIONS OF AN INITIALLY ISOTROPIC MATERIAL SHOWING ANISOTROPIC STRAIN-HARDENING, CREEP RECOVERY, AND SECONDARY CREEP, by J. F. Besseling. Rept. on Contract AF 49(638)223. Apr 58, 41p. 10 refs. SUDAER no. 78; AFOSR-TN-60-384.
Order from LC mi$3.30, ph$7.80 PB 148 749

Stress-strain relations are given for an initially isotropic material, which is macroscopically homogeneous, but inhomogeneous on a microscopic scale. An element of volume is considered to be composed of various portions, which can be represented by subelements showing secondary creep and isotropic work hardening in plastic deformation. If the condition is imposed that all subelements of an element of volume are subjected to the same total strain, it is demonstrated that the inelastic stress-strain relations of the material show anisotropic strain-hardening, creep recovery, and primary and secondary creep due to the non-uniform energy dissipation in deformation of the subelements. Only quasi-static deformations under isothermal conditions are considered. The theory is restricted to small total strains. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
THE STABILITY OF A CIRCULAR CYLINDER UNDER FINITE EXTENSION AND TORSION, by A. E. Green and A. J. M. Spencer. Technical rept. no. 12 for Sep 55-Jan 57 on Application of Invariance Principles in Continuum Mechanics, Contract DA 19-020-ORD-3487. Mar 57, 39p. 10 refs. Rept. DA-3487/12; OOR rept. 1271.16M.
Order from LC mi$3.00, ph$6.30 PB 138 003

A circular cylinder of isotropic, homogeneous elastic material is deformed by finite extension and torsion. The stability of the resulting equilibrium position is investigated by using the equations of the theory of small elastic deformations superposed on finite elastic deformations as the equations of neutral equilibrium of the body. These equations are formulated in terms of a general strain-energy function for the body, but in order to solve them the strain-energy function is specialized to the Neo-Hookean form.

Florida U. Engineering and Industrial Experiment Station, Gainesville, Fla.
LINE LOADINGS ON FINITE LENGTH CYLINDRICAL SHELLS: SOLUTION BY THE FINITE FOURIER TRANSFORM, by William A. Nash and T. F. Bridgland, Jr. Interim technical rept. no. 3 on Application of Shallow Shell Theory to Equilibrium and Buckling Phenomena, Contract DA 01-009-ORD-671. Mar 60, 10 refs. OOR rept. 2028.3-E.
Order from LC mi$2.70, ph$4.80 PB 148 438

The linear equations due to Flügge for the thin elastic circular cylindrical shell are solved by the use of the finite Fourier transform for two general cases of radial line loadings on a finite length shell. The loadings considered are: (a) an arbitrary line load acting along a generator and (b) an arbitrary line load applied around the circumference. The solution presents the orthogonal displacement components of the middle surface in the form of rapidly converging series. (Author)

Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.
ON THE GRIFFITH-IRWIN FRACTURE THEORY, by J. Lyell Sanders, Jr. Technical rept. no. 6 on Contract Nonr-1866(02). Sep 59, 7p. 3 refs. AD-226 049.
Order from LC mi$1.80, ph$1.80 PB 148 567

A new and simple mathematical formulation is given of the stability criterion for crack propagation according to the Griffith-Irwin theory (J. Appl. Mechanics, Sept. 1957). The derivation is made for the case of a crack in a plate where the plane stress theory applies, but it may be generalized easily to other cases (three-dimensional elasticity, shells, etc.). (Author)

Illinois Inst. of Tech., Chicago.
COMPARISON OF YIELD CONDITIONS FOR CIRCULAR CYLINDRICAL SHELLS, by Antonio Sawczuk and Philip G. Hodge, Jr., Rept. on Contract Nonr-1406(04). May 59, 16p. 6 refs. DOMIIT rept. no. 1-7.
Order from LC mi$2.40, ph$3.30 PB 146 589

The yield condition for a rigid-plastic circular cylindrical shell subjected to axially symmetric loading is described in terms of the circumferential hoop stress n and the axial bending moment m. Different yield conditions are obtained depending on whether the shell is of homogeneous of ideal-sandwich construction and on whether the shell material satisfies Tresca's or Mises' yield condition. Previous work has been limited to Tresca's yield condition.

Institute of Engineering Research, U. of California, Berkeley.
ON THE GENERAL PROBLEM OF ELASTOKINETICS IN THE THEORY OF SHALLOW SHELLS, by P. M. Naghdi. Technical rept. no. 5 on Contract Nonr-222(69). Aug 59, 37p. 9 refs. Series no. 131, issue no. 5; AD-227 106.
Order from LC mi$3.00, ph$6.30 PB 148 192

Nonlinear, as well as linear, elastokinetic problems of thin shallow shells are investigated. The case of cylindrical shells is also included and treated separately. It is shown that the elastokinetic problems of shallow shells may be characterized by a system of simultaneous nonlinear partial differential equations involving the axial displacement and a stress function. These equations are exact withing the scope of the theory of shallow shells. Through a suitable order of magnitude analysis and upon certain approximations, two other systems of equations are deduced; the latter, which neglects the effects of longitudinal inertia terms, reduces to the previously know results for transverse vibrations. Three systems of equations are also deduced for dynamical problems of circular cylindrical shells in terms of radial displacement and a stress function. The first of these is such that upon linearization it becomes equivalent to Donnell's equations. Wave propagation is discussed in an infinite cylindrical shell according to the linearized differential equations. (Author)

Mellon Inst., Pittsburgh, Pa.
RECENT RESULTS IN THE CONTINUUM THEORY OF VISCOELASTIC FLUIDS, by Bernard D. Coleman and Walter Noll (Carnegie Inst. of Tech.) Rept. on Contract AF 49(638)541 and National Science Foundation Grant NSF-G 5250. May 60, 85p. 28 refs. AFOSR-TN-60-606; AD-239 077.
Order from LC mi$4.80, ph$13.80 PB 148 527

Contents:
Some elementary kinematics
Simple fluids
  Compressible fluids
  Incompressible fluids
Simple shearing flow
Some other steady flows
  Poiseuille flow
  Special cases of helical flow
    Flow between concentric pipes
    Couette flow
Some oscillatory motions
Slow motions and Newtonian fluids
  An approximation theorem
Higher order corrections to the theory of perfect fluids
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AER, Inc. [Pasadena, Calif.]
RESPONSE OF MECHANICAL SYSTEMS TO RANDOM EXCITING FORCES, by Henry J. Stumpf. Rept. on Contract N123(60530)18702A. 1 Dec 59, 255p. 15 refs. Technical rept. 116; NOTS TP-2365; NAVORD rept. 7010; AD-234 535.
Order from LC mi$11.10, ph$39.60 PB 146 989

A brief discussion of linear vibrating systems is given, with special emphasis on multidegree-of-freedom systems. The reason that real normal modes do not exist unless the damping is of a special form is presented. A method for obtaining complex normal modes is reviewed. The problem of random exciting forces is considered, and the general techniques of the Fourier Series and Fokker-Planck methods are developed. Several detailed examples are given for both stationary and nonstationary inputs.

Avco-Everett Research Lab., Mass.
THEORY OF RADIATION FROM LUMINOUS SHOCK WAVES IN NITROGEN, by Peter Hammerling, J. Derek Teare, and Bennett Kivel. Rept. on Contracts AF 04(647)278 and DA 19-020-ORD-4862. June 59, 31p. 14 refs. Research rept. 49; AFBMD-TR-59-3; AD-220 509.
Order from LC mi$3.00, ph$6.30 PB 146 651

The physical properties behind a normal shock in nitrogen are calculated as a function of time. These include the variation of temperature, composition, ionization, and the intensity of radiation from the N_2^+ first negative band system. A particular case is considered for which experimental data are available, and regions sensitive to particular rates are indicated. A discussion of a method of determining the dissociation rate constants from measurements of the tails of radiation intensity profiles is appended. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
ON THE FLEXURE OF PLASTIC PLATES, by Samuel Lerner and William Prager. Technical rept. no. 50 on Contract Nonr-562(10). Sep 59, 7p. 9 refs. C11-50; AD-226 258.
Order from LC mi$1.80, ph$1.80 PB 148 579

The purpose of the present note is to draw attention to a simple test that provides a direct check on the fundamental assumptions of the theory, when the two principal bending moments have opposite signs.

Brown U. Div. of Engineering, Providence, R. I.
DESIGN AND OPERATION OF AN OSCILLATING-BODY VISCOMETER FOR GASES AT HIGH PRESSURES, by J. Kestin and W. Liedenfrost. Technical rept. no. 12 on Contract AF 18(600)891. Mar 60, 82p. 24 refs. AF 891/12; AFOSR-TN-60-375.
Order from LC mi$4.50, ph$13.80 PB 148 818

Satisfactory results could be obtained only with an oscillating system consisting of a flat, circular disk oscillating between two flat plates a small distance apart. Oscillating systems involving a free disk or a free sphere suffer from instabilities and do not yield satisfactory reproducibility. Oscillating systems involving concentric spheres with small gaps suffer from a large systematic error whose origin was not fully explored. (Author)

Aerodynamics and Pneumatics

Arnold Engineering Development Center, Tullahoma, Tenn.
BOUNDARY LAYER SEPARATION EFFECTS ON THE STATIC STABILITY OF A FLARED-TAIL MISSILE CONFIGURATION AT M = 2 TO 5, by J. Don Gray. Rept. on ARO, Inc., Contract AF 40(600)800. June 60, 24p. 4 refs. AEDC-TN-60-103.
Order from LC mi$2.70, ph$4.80 PB 148 100

Force and pressure measurements with a blunt-cone, cylinder-frustum configuration at M=2 to M=5 were made over a wide Reynolds number range to investigate the effects of boundary layer separation on the static stability parameters. C_{N_α} and x/l. Laminar boundary layer separations upstream of the flared tail produced stability parameters which were equal to or greater than those obtained when transition occurred far upstream of the flare (essentially no flow separation). Distributed roughness on the model nose essentially eliminated the variation of C_{N_α} and x/l with Reynolds number when $Re \geq 0.2 \times 10^6$, based on centerbody diameter. At Mach numbers of 4 and 5, an effect of model scale was present in the initial, normal-force curve-slope results for smooth models, whereas the center-of-pressure data were closely correlated by the free-stream Reynolds number. The test Reynolds number range was 0.06×10^6 to 3.3×10^6, based on centerbody diameter. (Author)

Arnold Engineering Development Center [Tullahoma, Tenn.]
AN INVESTIGATION OF SUPPORT INTERFERENCE ON AGARD CALIBRATION MODEL B, by C. J. Schueler. Rept. on ARO, Inc. Contract AF 40(600)800. Feb 60, 25p. 9 refs. AEDC-TN-60-35; AD-233 041.
Order from LC mi$2.70, ph$4.80 PB 146 569

Tests were conducted in the 12-in supersonic wind tunnel to determine the critical sting length for AGARD Calibration Model B with a sting-to-body diam ratio of 0.3. The tests were made at Mach numbers 2, 3, and 4 and covered a Reynolds number range of 3.5×10^6 to 13.5×10^6 based on the body length. The results indicate that the sting had no significant influence on the model surface pressure even when interference on base pressure was maximum. Over the Mach number and Reynolds number range of the tests, negligible interference was introduced by the windshield for sting length to model diameter ratios greater than 2.5. (Author)

Avco-[Everett] Research Lab., Mass.
AERODYNAMIC DISSIPATION, by H. E. Petschek. June 57, 22p. 8 refs. Research rept. 23; AD-201 438.
Order from LC mi$2.70, ph$4.80 PB 147 193

An attempt is made to re-examine the derivation of the basic aerodynamic flow equations in order (1) to discuss dissipation in a completely ionized gas in the presence of a magnetic field, and (2) to demonstrate that the basic microscopic dissipation mechanism is appreciably different.

Avco-Everett Research Lab., Mass.
AN EXPERIMENTAL AND THEORETICAL STUDY OF QUARTZ ABLATION AT THE STAGNATION POINT, by Mac C. Adams, William E. Powers, and Steven Georgiev. Rept. on Contract AF 04(647)278. June 59, 41p. 10 refs. Research rept. 57.
Order from LC mi$3.30, ph$7.80 PB 147 203

The ablation characteristics of fused quartz are determined experimentally utilizing an air arc wind tunnel. It is shown that opaque quartz will effectively absorb about 4000 Btu/lb and will radiate the aerodynamic heating, with negligible ablation, for a satellite trajectory.

Avco-Everett Research Lab., Mass.
EXPERIMENTAL STUDIES OF SHOCK WAVES IN NITROGEN, by John C. Camm and James C. Keck. Rept. on Contracts AF 04(647)278 and DA 19-020-ORD-4862. June 59, 23p. 4 refs. Research rept. 67, supersedes Research note 140; AFBMD-TN-59-9; AD-227 525.
Order from LC mi$2.70, ph$4.80 PB 147 209

Radiative relaxation behind shock waves in pure N is being studied to determine rate constants for recombination of N atoms. The radiation was measured as a function of wavelength for conditions corresponding to $T = 6000^\circ K$ with $\rho = 0.018 \rho_0$ and $T = 6300^\circ K$ with $\rho = 0.12 \rho_0$. The most prominent radiation in the wavelength interval studied is associated with the $N_2^+(1-)$ and $N_2(1+)$ bands. The intensity histories exhibit strong overshoot in the shock front for both bands and the peak to equilibrium intensity ratio was measured. Preliminary analysis of the final approach to equilibrium indicates that at $6400^\circ K$ the recombination rate constant for N atoms is $<0.3 \times 10^{-32}$ cm^6/sec when N_2 is the catalyst and 2.4×10^{-32} cm^6/sec when the N is the catalyst. (Author)

Avco-[Everett] Research Lab., Mass.
HEAT TRANSFER TO SATELLITE VEHICLES RE-ENTERING THE ATMOSPHERE, by N. H. Kemp and F. R. Riddell. Rept. on Contract AF 04(645)18. Oct 56, 32p. 8 refs. Research rept. 2 (formerly Research note 21).
Order from LC mi$3.00, ph$6.30 PB 146 655

A recently developed theory of heat transfer at high velocities and high altitudes is applied to the problem of a satellite vehicle entering the atmosphere. Circular re-entry orbits are considered for bodies under the influence of gravity and drag forces. Numerical results are presented which can be used to determine the conditions under which the survival of such a satellite may be expected. In addition, an analysis is made of the value of exerting a lift force on the re-entering vehicle as a means of preventing its destruction. (Author)

Avco-[Everett] Research Lab., Mass.
HYPERSONIC CONICAL SHOCKS FOR DISSOCIATED AIR IN THERMODYNAMIC EQUILIBRIUM, by Saul Feldman. May 57, 13p. 3 refs. Research rept. 12; AD-150 841.
Order from LC mi$2.40, ph$3.30 PB 147 190

Effort is made to solve the cone problem. The Taylor-Maccoll equation is set up for a dissociating gas in thermodynamic equilibrium. Solution of the conical shock equation is analyzed for an incompressible fluid downstream of the shock. A comparison of the pressure coefficients calculated from the exact solution and the approximate incompressible one shows very good agreement.

Avco-[Everett] Research Lab., Mass.
AN INVESTIGATION OF STAGNATION POINT HEAT TRANSFER IN DISSOCIATED AIR, by Peter H. Rose and F. R. Riddell. Rept. on Contract AF 04(645)18. Apr 57, 18p. 12 refs. Research rept. 7 [formerly Research note 32] AD-150 550.
Order from LC mi$2.40, ph$3.30 PB 147 189

Theoretical and experimental results are presented for laminar heat transfer at the stagnation point of a blunt body in hypersonic flow. Results are presented for air at temperatures up to 8000°K with up to 50% dissociation. In all cases the wall is relatively near room temperature. The experiments were performed in a shock tube and new experimental techniques are described. The data are compared with theoretical calculations including the effects of new physical phenomena, particularly dissociation, associated with high temperature air. (Author)

Avco-Everett Research Lab., Mass.
THE LARGE HIGH PRESSURE ARC PLASMA GENERATOR: A FACILITY FOR SIMULATING MISSILE AND SATELLITE RE-ENTRY, by P. Rose, W. Powers, and D. Hritzay. Rept. on Contracts AF 04(645)18 and AF 04(647)278. June 59, 35p. 12 refs. Research rept. 56; AFBMD-TR-59-6.
Order from LC mi$3.00, ph$6.30 PB 146 649

The development of an arc wind tunnel capable of stagnation pressures in the excess of twenty atmospheres and using as much as fifteen megawatts of electrical power is described. It is capable of reproducing the aerodynamic environment encountered by vehicles flying at velocities as great as satellite velocity. By the addition of a high capacity vacuum system, this facility can be used to produce the low density, high Mach number environment needed for simulating satellite re-entry, as well as hypersonic flight at extreme altitudes.

Avco-Everett Research Lab., Mass.
A NUMERICAL COMPARISON BETWEEN EXACT AND APPROXIMATE THEORIES OF HYPERSONIC INVISCID FLOW PAST SLENDER BLUNT-NOSED BODIES, by Saul Feldman. Rept. on Contract DA 19-020-ORD-4765. June 59, 21p. 13 refs. Research rept. 71; AD-226 728.
Order from LC mi$2.70, ph$4.80 PB 147 210

Calculations have been made of the flow field past a blunt body moving at hypersonic speeds through the atmosphere to include large distances downstream from the nose. Detailed profiles of the equilibrium thermodynamic functions and flow streamlines are presented for a hemisphere-cylinder moving through air at 60,000 ft. altitude at 17,500 ft/sec. A comparison is made between exact and approximate theories of the flow past slender blunt-nosed bodies, and it is shown that the second order blast wave theory could be used for the purpose of finding shock shape and the body pressure distribution. The present calculations could be used as an estimate of the inviscid wake left by a short blunt body in hypersonic flight. (Author)

Avco-Everett Research Lab., Mass.
ON ABLATING HEAT SHIELDS FOR SATELLITE RECOVERY, by Steven Georgiev, Henry Hidalgo, and Mac C. Adams. Rept. on Contract AF 04(647)278. July 59, 33p. 16 refs. Research rept. 65; AFBMD TR-59-7; AD-226 327.
Order from LC mi$3.00, ph$6.30 PB 147 207

Ablation is considered as a means of heat protection for recoverable satellites and a simple theory is presented for the energy absorbed per unit mass of ablated material. Experimental results, obtained in an air arc wind tunnel under simulated re-entry conditions, are presented for Teflon and Fiberglas. The results are shown to be in good agreement with the theory. Finally the insulation requirements for various types of heat shields are discussed and it is shown that a low temperature ablating heat shield is superior to both the heat sink and radiating heat shields. (Author)

Avco-[Everett] Lab., Mass.
ON THE INSTABILITY THEORY OF THE SOFT OR MELTED SURFACE OF AN ABLATING BODY WHEN ENTERING THE ATMOSPHERE, by Saul Feldman. Rept. on Contract AF 04(645)18, Aug 58, 41p. 11 refs. Research rept. 34; AD-205 515.
Order from LC mi$3.30, ph$7.80 PB 147 398

Some ablating bodies entering the atmosphere will melt or soften. Under deceleration, the soft or melted surface will tend to develop instabilities of the Lamb-

Taylor type. Two situations involving viscous incompressible fluids are investigated here: one where the liquid layer has constant viscosity and finite thickness, and the other, where the viscosity increases exponentially with distance away from the interface, and the layer is semi-infinite in extent.

Avco-[Everett] Research Lab. [Mass.]
PHYSICAL GAS DYNAMICS RESEARCH AT THE AVCO RESEARCH LABORATORY, by P. H. Rose. Rept. on Contract AF 04(645)18. July 57, 55p. 32 refs. Research rept. 9, formerly Research note 37; AD-150 790.
Order from LC mi$3.60, ph$9.30 PB 146 658

Physical gas dynamic problems associated with the high temperatures involved in flight at hypersonic Mach numbers are being studied. The central concept of this study is that the important elements of the environment anticipated can be duplicated in shock tubes. Several investigations, conducted in shock tubes, into critical gas dynamic problems associated with the high temperature are described. Heat-transfer measurements in the laminar, dissociated, boundary layer at the stagnation point are discussed. Measurements of the radiative emissivity and electrical conductivity of high-temperature air are described. Preliminary studies of magnetohydrodynamics are summarized.

Avco-Everett Research Lab., Mass.
RADIATION FROM HOT AIR AND STAGNATION HEATING, by Bennett Kivel. Rept. on Contracts AF 04(647)278 and DA 19-020-ORD-4862. Oct 59, 29p. 16 refs. Research rept. 79; AFBMD-TR-59-20; AD-232 836.
Order from LC mi$2.70, ph$4.80 PB 147 214

The radiation heating of the stagnation region for flight speeds up to 50,000 ft/sec is investigated using experimental shock tube data supplemented by theoretical estimates. Non-equilibrium effects which modify the radiation predictions at high altitudes ($\geq$30 mi) are pointed out. The radiation is compared with aerodynamic heating and is found to be important at high velocities ($\geq$30,000 ft/sec) and low altitudes ($\leq$25 mi). For this flight regime the dominant radiation results from the capture of electrons by nitrogen. (Author)

Avco-Everett Research Lab., Mass.
RADIATIVE TRANSPORT WITHIN AN ABLATING BODY, by Leo P. Kadanoff. Rept. on Contract AF 04(647)278. July 59, 39p. 7 refs. Research rept. 61; AFBMD TN-59-12; AD-220 505.
Order from LC mi$3.00, ph$6.30 PB 147 204

A method was developed for the calculation of net radiative flux and temperature distribution within a semi-infinite body which emits, absorbs, and scatters radiation and which allows some radiation to escape from its surface. This method was applied to the problem of calculating temperature distributions within bodies in steady state ablation.

Avco-[Everett] Research Lab., [Mass.]
STAGNATION POINT HEAT TRANSFER MEASUREMENTS IN DISSOCIATED AIR, by P. H. Rose and W. I. Stark. Rept. on Contract AF 04(645)18. Apr 57, 47p. 21 refs. Research rept. no. 3; AD-150 547.
Order from LC mi$3.30, ph$7.80 PB 146 656

The results of an experimental investigation of the laminar heat transfer at the stagnation point of a blunt body in partially dissociated air are presented and are compared to the theoretical treatment of Fay and Riddell. Heat transfer results are presented for air temperatures as high as 8000°K where more than 50% of the molecules are in the dissociated state. The experiments were performed in a shock tube and the new experimental techniques and principles are discussed briefly. Simulation of flight stagnation conditions at velocities up to satellite velocity 26,000 ft/sec. is shown to be possible in shock tubes and data has been obtained over a large altitude range at these velocities. (Author)

Avco-Everett Research Lab., Mass.
A THEORY OF ABLATION OF GLASSY MATERIALS FOR LAMINAR AND TURBULENT HEATING, by Henry Hidalgo. Rept. on Contract AF 04(647)278. June 59, 33p. 16 refs. Research rept. 62; AFBMD TN-59-13; AD-227 993.
Order from LC mi$3.00, ph$6.30 PB 147 205

The steady state equations of motion for a thin layer of an incompressible, glassy material on the surface of an ablating and radiating blunt body are reduced to a first order ordinary differential equation which is integrated numerically. This solution is coupled with the solution of the air boundary layer for both laminar and turbulent heat transfer with or without mass vaporization of the ablating material. The distribution of the effective energy of ablation around the body is thus obtained for a cone cylinder with a hemispherical cap that re-enters the atmosphere at hypersonic flight speeds, and has quartz as the ablating material. This solution of the equations of motion at the stagnation point was verified by arc wind tunnel experiments. The present state of development of the arc wind tunnel does not permit its use for experimental investigations of ablation around blunt bodies under turbulent heating. However, the complete understanding of the ablation process at the stagnation point coupled with the current knowledge of the turbulent heating rates provides solid grounds for the validity of this ablation theory around blunt bodies. (Author)

Avco-Everett Research Lab., Mass.
TRAILS OF AXI-SYMMETRIC HYPERSONIC BLUNT BODIES FLYING THROUGH THE ATMOSPHERE, by Saul Feldman. Rept. on Contract DA 19-020-ORD-4765. Dec 59, 94p. 12 refs. Research rept. 82; AD-233 703.
Order from LC mi$5.40, ph$15.30 PB 147 215

The trail left in the atmosphere by a body moving at hypersonic speeds is the subject of a theoretical treatment, in which the trail is divided into 2 regions: (1) the expansion-controlled trail, which treats the behavior of the wake behind the body up to a point,

along the direction of flight, where the pressure decays to the free stream value and cooling is principally controlled by the expansion of the flow; and (2) the conduction-controlled trail, where the trail cools mainly by diffusion of heat away from the high temperature core. Results of calculations that assume thermodynamic equilibrium of the flow field give the values of the thermodynamic variables in the trail of a sphere, axial distributions of emitted thermal radiation and maps of electron density distribution. Viscous effects in blunt body trails are of small importance and the cooling of the conduction-controlled trail is essentially due to conduction of heat. This portion of the trail does not widen as one proceeds downstream. Flight velocities considered vary between 15,000 and 35,000 ft/sec and altitudes range between 100,000 and 250,000 ft. (Author)

Avco-[Everett] Research Lab., Mass.
TURBULENT HEAT TRANSFER THROUGH A HIGHLY COOLED PARTIALLY DISSOCIATED BOUNDARY LAYER, by Peter H. Rose, Ronald F. Probstein, and Mac C. Adams. Rept. on Contract AF 04(645)18. Jan 58, 58p. 15 refs. Research rept. 14; AD-159 548.
Order from LC mi$3.60, ph$9.30 PB 147 191

The problem of heat transfer from high temperature air through a turbulent boundary layer to a cold surface is considered both analytically and experimentally. Heat transfer data obtained in shock tubes are presented and correlated by a semi-empirical theory which includes the effect of atomic diffusion. The distinguishing characteristics of turbulent boundary layers with dissociation and large cooling are considered. It is shown that the equations governing such flow, after certain approximations, can be represented in a form similar to the classical equations for a turbulent bound ary layer.

Avco-Everett Research Lab., Mass.
VISCOUS AERODYNAMIC CHARACTERISTICS IN HYPERSONIC RAREFIED GAS FLOW, by Ronald F. Probstein and Nelson H. Kemp. Rept. on Contract AF 04(647)278. Dec 59, 71p. 26 refs. Research rept. 48 (Rev.); AFBMD-TR-59-2.
Order from LC mi$4.50, ph$12.30 PB 146 652

This paper considers the problem of calculating viscous aerodynamic characteristics of blunt bodies at hypersonic speeds and at sufficiently high altitudes where the appropriate mean free path becomes too large for the use of familiar boundary layer theory but not so large that free molecule concepts apply.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
INTERFEROMETRIC STUDY OF THE BLUNT BODY PROBLEM, by R. Sedney and G. D. Kahl. Apr 60, 37p. 15 refs. Rept. no. 1100.
Order from LC mi$3.00, ph$6.30 PB 148 744

An experimental investigation of the flow fields around spheres in free flight was made using the optical interferometer. Data were taken for Mach numbers approximately 5 in argon, nitrogen, and air. For the temperatures existing behind the shock in nitrogen, vibrational excitation should occur but is not found. This is explained by the long relaxation path length compared to the scale of the experiment. If relaxation occurs at all it will be confined to a thin layer contiguous to the body. Evidence of molecular vibrations is found for the air test but slightly more than would be expected assuming that the oxygen is excited and the nitrogen frozen. A method of obtaining all flow variables, given the density is explained; it uses only the principles of conservation of mass and energy. (Author)

Combustion [Aerodynamics] Lab., Harvard U., Cambridge, Mass.
THE PROPAGATION OF TURBULENCE INTO A LAMINAR BOUNDARY LAYER, by Morton Mitchner. Interim technical rept. no. 3 on Contract DA 19-020-ORD-1029. June 52, 175p. 30 refs. AD-11 945.
Order from LC mi$8.10, ph$27.30 PB 149 269

The following topics are discussed: propagation of turbulence in open channel flow, experimental procedure, propagation of turbulence in a boundary layer, mechanism for the propagation of turbulence, and some considerations on the growth and decay of vorticity. A calculation for the minimum value of the jump height ratio, and the induced velocity for bounded regions are discussed in appendixes.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
HYPERSONIC RESEARCH SUMMARY, by G. J. Fabian. Rept. on Contract AF 18(603)141. June 60, 28p. 17 refs. Rept. no. AD 1118-A-11; AFOSR-TR-60-58.
Order from LC mi$2.70, ph$4.80 PB 148 357

Various research areas investigated are reported in summary, giving reference to the different publications generated. The program areas include early work on the wave superheater and related research on chemical nonequilibrium in high-temperature gas flows, a radiation probe, sound propagation in an excited or dissociated gas, boundary layer phenomena in high-temperature gas flows, and molecular interaction at high-temperatures. (Author)

David Taylor Model Basin, Washington, D. C.
PRESSURE FLUCTUATIONS ON THE WALL ADJACENT TO A TURBULENT BOUNDARY LAYER, by Mark Harrison. Dec 58, 14p. 7 refs. Rept. 1260; AD-209 434.
Order from LC mi$2.40, ph$3.30 PB 148 033

A fully developed turbulent boundary layer with a zero pressure gradient has been studied in a subsonic wind tunnel. The pressure fluctuations on the wall of the wind tunnel were measured by small flush-mounted microphones. Data for the dimensionless spectral density of the pressure fluctuations, $P(f)/\rho^2 U_o^3 \delta^*$, as a function of the frequency parameter $f\delta^*/U_o$ are presented; $P(f)$, ρ, U_o, δ^*, and f are respectively the spectral density, fluid density, free stream velocity, boundary layer displacement thickness, and frequency. Data for the coefficient $(p^2)^{1/2}/1/2\rho U_o^2$ are also presented. The transverse cross correlation for the pressure fluctuations was studied by using two flush mounted microphones.

Rather than the longitudinal cross correlation, the longitudinal cross spectral density was studied, yielding a measure of the coherence of the pressure fluctuations at two points as a function of $f\xi/U_c$, where ξ is the longitudinal spacing of the two points and U_c is the effective convection velocity of the spatial pattern. (Author)

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
A KINETIC THEORY DESCRIPTION OF RAREFIED GAS FLOWS, by Lester Lees. Rept. on Hypersonic Research Proj., Contract DA 04-495-ORD-19. 15 Dec 59, 89p. 44 refs. Memo no. 51; AD-233618.
Order from LC mi$4.80, ph$13.80 PB 147 240

An approach to the kinetic theory of gas flows is developed which starts with Maxwell's original integral equations of transfer, rather than with the Maxwell-Boltzmann equation for the velocity distribution function itself. The advantage of this method is that relatively simple distribution functions are utilized which contain a small number of unknown functions to be determined by applying the conservation laws, plus several additional higher moments. For simplicity a 2-stream Maxwellian is employed, which is a natural extension and generalization of Mott-Smith's function for a normal shock, but differs from it in certain essential respects. This technique is now being applied to some typical non-linear rarefied gas flows. (Author)

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
MAGNETOHYDRODYNAMIC SIMPLE WAVES, by J. D. Cole and Y. M. Lynn. Rept. on Contract AF 49(638)476. Dec 59, 54p. 9 refs. AFOSR Technical note 59-1302; AD-234 739.
Order from LC mi$3.60, ph$9.30 PB 148 688

A study is made of simple wave flows of an infinitely conducting perfect gas (polytropic) in the presence of an arbitrarily oriented magnetic field. From group theoretic considerations the problem is reduced to the solution of a first-order differential equation which is integrated numerically. Properties of solutions and examples are discussed. (Author)

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
STABILITY OF THE COMPRESSIBLE LAMINAR BOUNDARY LAYER, by Eli Reshotko. Rept. on Hypersonic Research Proj., Contract DA 04-495-ORD-19. 15 Jan 60, 168p. 21 refs. Memo. no. 52; AD-233 619.
Order from LC mi$7.80, ph$25.80 PB 147 239

As a result of a study of the stability of the compressible laminar boundary layer, it was concluded that neutral stability is achieved when the net energy transferred from the mean flow to the disturbance flow by the action of Reynolds stress is exactly dissipated. However, the relative importance of the various mechanisms changes with Mach number, so that the neutral stability diagram for a hypersonic flow might not be recognized in terms of its incompressible counterpart. Among the changes are the following: (1) The rate of conversion of energy from the mean flow to the disturbance flow through the action of the viscosity in the vicinity of the wall increases with Mach number; (2) Instead of being nearly constant across the boundary layer, the amplitude of inviscid pressure fluctuations for Mach numbers greater than 3 decreases markedly with distance outward from the plate surface, and (3) At Mach numbers less than about 2, dissipation effects are minor, but they become extremely important at higher Mach numbers, since for neutral disturbances, they must compensate for the generally destabilizing effects of items 1 and 2 above. (Author)

Institute of Engineering Research, U. of California, Berkeley.
DESIGN, FABRICATION, AND EVALUATION OF AXISYMMETRIC NOZZLES, by Larry L. Lynes. Master's thesis. Rept. on Contract Nonr-222(45). 10 Sep 59, 50p. 9 refs. Technical rept. HE-150-174; Series no. 20, issue no. 132; AD-226 224.
Order from LC mi$3.30, ph$7.80 PB 148 616

The pumping capacity of the no. 3 wind tunnel was increased in 1954 in order to accommodate a Mach 6 nozzle of a usable test section size. This increased capacity left the previous nozzles still usable in their own range, but with a smaller test section size than would have been available with the increased capacity. Since it is most desirable to have as large a test section as possible, it is necessary to have the nozzles designed at maximum capacity. Scaling procedures are given for increasing the size of the existing nozzles to meet the increased capacity. This was accomplished by application of scaling laws to a Mach 4 nozzle, followed by fabrication and experimental evaluation of the resulting nozzle. (Author)

Laboratorio di Meccanica Applicata del Politecnico di Torino (Italy).
ON THE EXISTENCE OF INFINITE ACCELERATION POINTS IN TRANSONIC FLOWS AROUND AIRFOILS WITH FINITE CURVATURE, by Silvio Nocilla. Technical note 11 on Contract AF 61(514)1124. Dec 58, 20p. 6 refs. AFOSR-TN-59-197; AD-211 474.
Order from LC mi$2.40, ph$3.30 PB 147 445

The problem is investigated of the formation of shock waves around airfoils with finite curvature in transonic flow. As a suitable criterion for the theoretical interpretation of the appearance of such a shock wave it is assumed the appearing of a point with infinite acceleration on the physical plane. The conditions which must be fulfilled on the hodograph plane in order that such a point exists, and the properties which must possess the corresponding stream function are studied. The theory is then applied to airfoils with constant curvature. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
GENERAL RESEARCH IN FLIGHT SCIENCES. VOLUME I, PART ONE: FLUID MECHANICS. Technical rept. for Jan 59-Jan 60. Jan 60, 334p. 80 refs. LMSD-288139.
Order from LC mi$11.10, ph$51.60 PB 148 399

Contents:
The effect of body forces on melting ablation at a stagnation point
Radiant energy transfer in gaseous flow
A numerical method of solution for heat conduction In composite slabs with a receding surface
On mass transfer and shock-generated vorticity
The effect of shock-generated vorticity, surface slip, and temperature jump on stagnation-point heat-transfer rates
Hypersonic flow around bodies of revolution which are generated by conic sections
Kinematic formulation of rotational gas flow
Hypersonic flow around blunt bodies of revolution whose shock waves are generated by conic sections

Lockheed Aircraft Corp., Sunnyvale, Calif.
GENERAL RESEARCH IN FLIGHT SCIENCES. VOLUME II: MECHANICS OF DEFORMABLE BODIES. Technical rept. for Jan 59-Jan 60. Jan 60, 456p. 111 refs. LMSD-288139.
Order from LC mi$11.10, ph$69.60 PB 148 399-2

Contents:
Buckling of a cylindrical shell of arbitrary length under a circumferential band of pressure (LMSD-49798)
Prebuckling deflection stresses in a circular cylinder subjected to a saddle-type load (LMSD-288007)
Approximate analysis of damped, linear vibrations
Large deflection and buckling analysis of circular cylindrical shells (LMSD-48393, rev.)
Approximate buckling loads by energy methods (LMSD-480068)
On determing biaxial stress yield and fracture criteria for hot pressed beryllium at room and elevated temperature (LMSD-49756)
Stresses in spherical pressure vessels (LMSD-288109)
A statistical analysis of axially loaded cylinder buckling data (LMSD-49741)
Shock response of a nonlinear missile suspension system
Elasto-plastic analysis of shells of revolution subjected to heating and external loads
Spring characteristics of long tubular air cushions (LMSD-49729)
The initial response of an elastic spherical shell to a step pressure wave
The effect of residual stresses on the critical crack length predicted by the Griffith theory
Stresses generated by suddenly introducing a moving crack into a stretched elastic sheet (See also PB 148 399-1)

Lockheed Aircraft Corp., Sunnyvale, Calif.
GENERAL RESEARCH IN FLIGHT SCIENCES. VOLUME IV: MATHEMATICS AND STATISTICS. Technical rept. for Jan 59-Jan 60. Jan 60, 172p. 32 refs. LMSD-288139; AD-234 999.
Order from LC mi$8.10, ph$27.30 PB 148 399-4

Contents:
Interval analysis I (LMSD-285 875)
Convergence of approximate eigenvectors in Jacobi methods
Word correlation study (LMSD-311 696)
Efficient estimation of regression parameters
For second order stationary processes (LMSD-288 079)
A model of turbulence displaying autonomous oscillations (LMSD-48 446)
(See also PB 148 399-3)

Massachusetts Inst. of Tech., Cambridge.
ESTIMATION OF UNSTEADY AIRLOADS ON BLUNT BODIES IN A HYPERSONIC STREAM. PART I. THEORY, by Haim Kennet. Rept. on Contract AF 49(638)160. Oct 59, 55p. 19 refs. Fluid Dynamics Research Group rept. no. 59-6; OSR Technical note no. 59-1273; AD-232 606.
Order from LC mi$3.60, ph$9.30 PB 146 335

A theoretical method is developed for estimating aerodynamic loads on symmetric blunt-nosed bodies, at zero angle of attack, performing small-amplitude harmonic oscillations in a main hypersonic stream. Time dependent effects are introduced as small perturbations superimposed on an approximate steady field. A power series solution yields the perturbation pressure distribution on the body. Shock amplitude and phase angle are also obtained. The results are applied to a spherical cap, in which the case the leading terms of the series solution are evaluated. (Author)

Mississippi State U. [State College].
FLIGHT RESEARCH INVESTIGATION OF LAMINAR SEPARATION OF A HIGH LIFT BOUNDARY LAYER CONTROL AIRPLANE, by Dezso Gyorgyfalvy. Research rept. no. 25 on Contract Nonr-978(01). 26 June 59, 74p. 8 refs. AD-225 178.
Order from LC mi$4.50, ph$12.30 PB 147 450

A study was made of a technique for calculating and measuring laminar separation in connection with a flight research investigation of the droop nose as an aid in delaying the leading edge stall. The calculation of laminar separation by means of the Holstein-Thwaites method proved to be unsatisfactory; but the simple relation $U_{sep}/U_{max} = 0.94$, was found to be a good approximation. The droop nose proved to be advantageous. However the attainable gain in maximum lift was not more than about 20%. (Author)

National Research Labs., Ottawa (Canada).
STRUCTURAL ANALYSIS OF MULTI-HINGED CONTROL SURFACES, by E. Kosko. Mar 60, 174p. Aeronautical rept. LR-276.
Order from LC mi$8.10, ph$27.30 PB 148 519

An elastic small-deflection analysis is presented of a control surface supported on a structure by means of three or more hinges. Effects of sympathetic flexure, of local bracket flexibility and of angular deflection are taken into account. The existence is shown of an elastic hinge moment, quadratically dependent on the external loading. Application of the method is illustrated by numerical examples, which show that some secondary effects may become more critical than those of direct loading. (Author)

Naval Ordnance Lab., White Oak, Md.
MAGNUS MOMENT ON PURE CONES IN SUPERSONIC FLIGHT, by John D. Nicolaides and John J. Brady. 20 Jan 59, 42p. 15 refs. NAVORD rept. 6183; AD-219 843.
Order from LC mi$3.30, ph$7.80 PB 148 451

By aeroballistic range techniques, the Magnus moment is measured on 20° pure cones at M = 2. The results indicate that the Magnus moment may be critically dependent, in both size and sign, on the nature of the boundary layer (i.e., laminar, turbulent, or mixed). The normal force and damping moment are also found to be significantly dependent on the nature of the boundary layer. The characteristics of the boundary layers are revealed in the spark shadowgraphs of the aeroballistic range technique and its transient and sometimes chaotic character noted. Criteria for specifying the general nature of the boundary layer are evolved and used to correlate the coefficient data. The experimental force and moment coefficients are compared with theoretical values obtained from various suggested physical models of the flow. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
THE EFFECTS OF ELEVATED TEMPERATURES ON AIRCRAFT STRUCTURES: AN OUTLINE OF SOME PROBLEMS AND RESULTS, by Frederick V. Pohle. Rept. on Contract Nonr-839(23). Aug 59, 24p. 67 refs. PIBAL rept. no. 495.
Order from LC mi$2.70, ph$4.80 PB 148 176

This report outlines some problems and results in heat transmission in the structure, in thermal stresses due to external heating, and in thermal buckling.

Polytechnic Inst. of Brooklyn, N. Y.
ON A NEW APPROACH FOR THE SOLUTION OF NON-SIMILAR BOUNDARY LAYER PROBLEMS, by Luigi G. Napolitano and Antonio Ferri. Rept. on Contract AF 49(638)217. Mar 60, 39p. 3 refs. PIBAL rept. no. 507; AFOSR-TN-59-356.
Order from LC mi$3.00, ph$6.30 PB 148 557

A new method of solution for non-similar dissipative flow fields is proposed which is essentially based on the description of such flow fields by means of "inner" and "outer" profiles jointed along a continuous "matching" line lying within the field itself. The inner and outer profiles are single-parameter profiles derived from the solution of a total differential equation upon which not all the pertinent physical conditions are necessarily imposed. The "inner" profiles are in fact the inner part of solutions for which the conditions of boundness at infinity have not been imposed. The "outer" profiles are the outer part of solutions which do not satisfy the true physical similarity requirements at the wall.

Polytechnic Inst. of Brooklyn, N. Y.
RECENT DEVELOPMENTS CONNECTED WITH THE HYPERSONIC FACILITY OF THE POLYTECHNIC INSTITUTE OF BROOKLYN. PART I. TESTS OF THE COMPRESSION HEATER. PART II. ASPECTS OF THE DESIGN, CONSTRUCTION, AND INSTALLATION ON A MULTIPLE-OUTLET COLLECTION FOR THE CONVECTION HEATER, by Sergio R. Panunzio. Rept. on Research on Utilization of the Hypersonic Wind Tunnel, Contract AF 33(161)3978. Oct 59, 29p. 11 refs. WADD Technical rept. 60-94.
Order from OTS $0.75 PB 161 882

Two recent developments are described in this report. The first pertains to tests of the compression heater; these were carried out in order to evaluate the utility of the compression heater for hypersonic testing. The results of the tests indicate that there is a substantial air leakage past the piston of the heater, causing unsatisfactory heater performance. This leakage occurs in both directions during various phases of the compression cycle. Alterations in the design of the diaphragm are clearly required before improved performance can be anticipated. The second development discussed in this report pertains to the design and installation of a collector which permits the operation of several wind tunnels as well as of the compression heater from the convection heater. This collector increases to a considerable degree the capabilities of the hypersonic facility. In this report the design considerations and analysis of the collector are outlined and the pertinent construction details discussed. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
TRANSIENT TEMPERATURE DISTRIBUTIONS IN A SPHERE DUE TO AERODYNAMIC HEATING, by Frederick V. Pohle and John L. Boccio. Rept. on Contract Nonr-839(23). Sep 59, 32p. 10 refs. PIBAL rept. no. 553; AD-225 844.
Order from LC mi$3.00, ph$6.30 PB 148 891

The 2-dimensional transient heat condition problem for a solid sphere with constant properties was solved for the case of rotational symmetry and a surface temperature that varied with time and latitude. For given surface conditions this solution can be used to determine the heat input at the surface; these results were compared with similar values computed from a one-dimensional insulated plug experiment. In addition the experimentally determined internal temperatures were compared with those predicted by the 2-dimensional theory. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
TURBULENT HEAT TRANSFER ON BLUNT-NOSED BODIES IN TWO-DIMENSIONAL AND GENERAL THREE-DIMENSIONAL HYPERSONIC FLOW, by Roberto Vaglio-Laurin. Rept. on Aerodynamic Research, Contract AF 33(616)3265. Sep 58, 49p. 22 refs. WADC Technical note 58-301; AD-206 050.
Order from LC mi$3.30, ph$7.80 PB 149 283

Recent results obtained for three-dimensional laminar boundary layers are extended to the turbulent case. It is shown that in the presence of highly cooled surfaces and of moderate Mach numbers of the outer stream, the crossflow and the pertaining Reynolds stresses in a general three-dimensional turbulent boundary layer are negligible even for large transversal pressure gradients. The demonstration assumes that Reynolds analogy is satisfied by the flow in the streamline direction; subsequently, the validity of this assumption is established by extending a correlation due to Mager between-two-dimensional compressible and incompressible turbulent boundary layers. From a study of the transformation and of its implications, a rapid method for the analysis of the boundary layer flow under the subject conditions is established. In the absence of general three-dimensional data, a comparison with experiments and with

the predictions of other known analyses is presented for several axisymmetric configurations; the results of the method proposed here exhibit good agreement with the data. The equations governing the mean motion in a general compressible three-dimensional turbulent boundary layer are derived in an appendix. (Author)

Princeton U., N. J.
HYPERSONIC VISCOUS FLOW PAST A BLUNT BODY WITH AN APPLIED MAGNETIC FIELD. PART II, by Ching-Sheng Wu. Rept. on Contract AF 49(638)465. Aug 59, 28p. 10 refs. Rept. no. 443; AFOSR-TN-60-210. AD-235 786.
Order from LC mi$2.70, ph$4.80 PB 148 347

The main purpose of the present investigation is to study how much the skin friction and heat transfer rate will be reduced by the presence of hydromagnetic interaction. In fact, the present analysis has simplified the physical model considerably.

Research Labs. for the Engineering Sciences, U. of Virginia, Charlottesville.
FREE MOLECULE COUETTE FLOW BETWEEN ROTATING CYLINDERS, by J. H. Bodine and A. R. Kuhlthau. Rept. on Contract NOrd 18211. Mar 60, 19p. 2 refs. Rept. no. AST-2849-102-60U.
Order from LC mi$2.40, ph$3.30 PB 148 389

It is the purpose of this paper to present a detailed theoretical analysis of the free-molecule flow which is amenable to experimental check and thus may provide a means for a more careful estimate of the numerical value of the reflection parameter.

Rome U. (Italy).
TRANSIENT TEMPERATURES AND THERMAL VIBRATIONS IN SPACE STRUCTURES, by Luigi Broglio. Technical note no. 2 on Contract AF 61(052)198. June 59, 58p. 4 refs. SIARgraph no. 53; AFOSR-TN-59-1014; AD-230 271.
Order from LC mi$3.60, ph$9.30 PB 146 708

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
APPROXIMATE THEORY OF GROUND INTERFERENCE ON SLENDER ROCKET SLEDS OF ARBITRARY CROSS SECTION WITH APPLICATION TO THE CONFIGURATION ROCKETDYNE RS-2 SLED, by Rudolf Hermann and Walter L. Melnik. Rept. on Contract AF 29(600)2102. Jan 60, 34p. 7 refs. AFMDC-TR-60-1; AD-234 280.
Order from LC mi$3.00, ph$6.30 PB 146 379

The pressure distribution on slender rocket-propelled sled bodies moving along the ground is computed for subsonic and moderate supersonic Mach numbers. The flow about a slender body of arbitrary cross section is approximated by superposition of locally tangent conical fields along the axis of the body and its image. This method is used to calculate the pressure distribution on configuration Rocketdyne RS-2 sled for M= 0.7, 0.8, 1.5, 2.0, and 2.4. The normal force loading and lift coefficient are obtained from an integration of the pressure distribution. Comparison with the lift coefficient measured by AEDC at M = 2 on a model of this sled configuration having zero nose droop indicates very good agreement with theory. (Author)

Rosemount Aeronautical Labs., U. of Minnesota Minneapolis.
EXPERIMENTAL AERODYNAMIC INVESTIGATION OF BASIC ROCKET SLED CONFIGURATIONS M = 1.5 TO M = 3.0, by Rudolf Hermann, Frederick Moynihan, and Howard Peterson. Rept. on Contract AF 29(600)2003. Oct 59, 63p. 3 refs. RAL-RR-167; AFMDC-TR-59-41; AD-233 789.
Order from LC mi$3.90, ph$10.80 PB 146 380

Wind tunnel measurements of the drag, lift, center of pressure location and pitching moment for some basic sled shapes and orientation parameters under the influence of ground effects are presented and discussed. Sled models were mounted on a simulated Holloman track cross section. Mach number range is from 1.5 to 3.0. Sled geometric variables include nose shape and angle on a circular cross-section sled, and body width on a rectangular cross-section sled. Sled orientation variables include height above the trough and angle of attack. Presence of the ground has little effect on the sled drag if it is mounted above the level of the rails. However, the ground effect caused positive lift loads which for many configurations were in the order of, or larger than the drag.

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
RESEARCH ON EVAPORATIVE FILM COOLING OF A MACH NUMBER 7 CONTOURED WIND TUNNEL NOZZLE IN THE ROSEMOUNT AERONAUTICAL LABORATORIES' HYPERSONIC FACILITY, by Rudolph Hermann, Walter L. Melnik, and Janis O. A. Stankevics. Rept. for 1 Oct 58-30 Sep 59 on Contract AF 33(616)6077. May 60, 63p. 38 refs. WADD Technical rept. 60-251.
Order from OTS $1.75 PB 161 885

An experimental research program on evaporative film cooling of a Mach Number 7 Laval nozzle was conducted in the 12 x 12-inch test section of the hypersonic blowdown wind tunnel. Cooland (water) was injected through a thin strip of porous stainless steel plate located upstream of the nozzle throat where the average Mach number was 0.10. The object of this investigation was to analyze the influence of evaporative film cooling on the potential flow area available for model testing. For this purpose, a transverse pitot pressure and total temperature survey was performed in the uniform flow region of the test section. Impact pressure and total temperature measurements were made in the turbulent boundary layer on the wall at the nozzle exit where M 7 with stagnation temperatures up to 2040°R. The results are compared to a former investigation of evaporative film cooling in a throat section of a hypersonic nozzle. Results of a simplified theoretical analysis of evaporative film cooling showed good agreement with wall temperatures measured at the throat of the nozzle. Concentration and total enthalpy profiles across the boundary layer were obtained from a simi-

larity analysis of the binary turbulent boundary layer with evaporative film cooling using some experimental data. (Author)

Southwest Research Inst., San Antonio, Tex.
AN ALTERNATIVE FORMULATION OF THE PROBLEM OF FLUTTER IN REAL FLUIDS, by Wen-Hwa Chu and H. Norman Abramson. Technical rept. no. 2 on Contract Nonr-2470(00). 29 Aug 58, 20p. 10 refs. AD-204 388.
Order from LC mi$2.40, ph$3.30 PB 147 160

The potential theory of a harmonically oscillating thin airfoil is generalized by discarding the conventional Kutta-Joukowski condition at the trailing edge and introducing a generalized equivalent condition. The bound vorticity distribution is expressed in a form of the Birnbaum-Glauert formula and the resulting equation is solved by application of Glauert's series method. The lift and moment, which depend upon the trailing edge singularity, are found to contain two complex semi-empirical parameters which may be evaluated from experimental data. The implications of these results in various applications are discussed.

Technische Hochschule, Vienna (Austria).
CONDUCT THEORETICAL RESEARCH ON THE STRENGTH OF VORTICES PRODUCED BEHIND A SHOCK WAVE IN THE BOUNDARY LAYER FOR SUPERSONIC FLOW, by Rudolf Bruniak. Technical final rept. on Contract AF 61(052)78. [1960] 15p. AFOSR-TR-60-18; AD-232 069.
Order from LC mi$2.40, ph$3.30 PB 146 710

The present paper undertakes to investigate vortices appearing behind a shock wave in the boundary layer as to their strength and their influence on the thickness of the boundary layer.

Technische Hochschule, Munich (West Germany).
LINEAR SUPERSONIC FLOW PAST COMBINATIONS OF A CYLINDRICAL BODY AND TRIANGULAR WINGS, by Ferdinand Peischl and Hans J. Stetter. Technical note. no. 11 on Contract AF 61(514)1080. 24 Nov 59, 28p. 13 refs. AFOSR-TN-59-1160; AD-233 274.
Order from LC mi$2.70, ph$4.80 PB 146 737

The normalized pressure-distribution was computed for wing-body combinations consisting of an infinite (rotational) cylindrical body and plane delta-wings with supersonic leading edges. Linear supersonic theory was used without further approximations. After an introduction of quasi-cylindrical wing-body interference theory and the statement of the problem, the non-trivial second step of the procedure is solved analytically. This solution is Fourier-analyzed numerically to yield the boundary data for the third step the computations of which were described previously. The pressure distribution is shown in several graphical representations and a discussion of the results is given. All computations were made on the PERM electronic computer. (Author)

Texas Engineering Experiment Station, College Station.
WIND TUNNEL STUDIES OF PRESSURE AND VELOCITY DISTRIBUTION, by Edwin S. Holdredge and Bob H. Reed. Summary rept. no. 2 for 1 Sep 56-21 Aug 57. [1957] 52p. AD-148 336.
Order from LC mi$3.60, ph$9.30 PB 148 229

The scope of this report is limited to the investigation and results of studies on single obstacles having rectangular shapes. Most of the previous work on the velocity around objects has dealt with problems related to windbreaks. Since the windbreak is long compared to its height the air flows in a vertical plane. The present studies are of three dimensional objects and the flow is three dimensional.

University of Southern California, Engineering Center, Los Angeles.
REDUCTION OF THE BOUNDARY LAYER THICKNESS IN A HYPERSONIC NOZZLE, by Serge A. Waiter. Rept. on Contract AF 18(603)95. 20 May 60, 28p. 3 refs. USCEC rept. 56-213; AFOSR-TN-60-514.
Order from LC mi$2.70, ph$4.80 PB 148 355

The reduction of the boundary layer thickness in a hypersonic nozzle can be realized by cooling the walls: in this way, an important heat transfer from the flow is created, increasing the density in the boundary layer. The integration of the mass flow equation will show the influence of the wall temperature on the boundary layer thickness. Applications to specific cases are proposed for a given nozzle. The following results are observed: (1) the power needed for cooling the nozzle is low, (2) this power varies slowly with the wall temperature (if $T_w < 200^oK$) but decreases with the Reynolds number and the stagnation temperature for a given Mach number. Charts are given for $8 \leq M \leq 18$ and for stagnation temperature $T_s \leq 2000^oK$. For higher temperatures, dissociation and ionization appear so the problem must be solved for each special case: the general heat transfer equation is given and its application is easy if the stagnation conditions and the local Mach number are known. (Author)

Hydrodynamics, Hydraulics, and Hydrostatics

St. Anthony Falls Hydraulic Lab., U. of Minnesota, Minneapolis.
THE ST. ANTHONY FALLS HYDRAULIC LABORATORY GRAVITY-FLOW FREE-JET WATER TUNNEL, by Edward Silberman and John F. Ripkin. Rept. on [Contract Nonr-710(24)]. Aug 59, 49p. 5 refs. Technical Paper no. 24, Series B.
Order from LC mi$3.30, ph$7.80, PB 148 166

A unique facility for studying cavitation phenomena has been developed at the St. Anthony Falls Hydraulic Laboratory of the University of Minnesota in the form of a gravity-flow free-jet water tunnel which makes use of the 50-ft drop in the Mississippi River at the Falls where the Laboratory is situated. The tunnel is an outgrowth of projects sponsored by the Office of Naval Research and is used for experimental

studies of cavities under an exceptionally wide range of conditions, especially at small cavitation numbers Both axially symmetric and two-dimensional test sections have been provided. The facility differs from customary water tunnels in that the test jet is surrounded by a gas-filled chamber in which the pressure can be lowered to nearly vapor pressure of the liquid stream. Operation is entirely by gravity flow; no pumps are required either for actuating the stream or producing vacuum in the test chamber. The test jet is vertical, 40 in. long, and flows at speeds up to 50 fps. The axially symmetric jet is 10 inches in diameter, while the alternate two-dimensional jet is 5 in. thick between rigid walls and of adjustable width from 6 to 15 in. between free boundaries.

St. Anthony Falls Hydraulic Lab., U. of Minnesota, Minneapolis.
EXPERIMENTAL STUDIES OF PNEUMATIC AND HYDRAULIC BREAK-WATERS, by Lorenz G. Straub, C. E. Bowers, and Zal S. Tarapore. Rept. on Contract Nonr-710(10). Aug 59, 58p. 28 refs. Technical Paper no. 25, Series B.
Order from LC mi$3.60, ph$9.30 PB 148 167

Experimental studies were conducted on two similar models of both pneumatic and hydraulic breakwaters, having a length ratio of 4.5:1. Tests of the pneumatic system indicated that the horsepower requirements for a given percentage of attenuation depended only on the wave length, the submergence of the manifold, and the depth of water. Multiple-manifold breakwaters with different spacing between manifolds were tried and found to be of no particular advantage over the one-manifold system. An intermittent bubbler device was also tested very briefly, showing very little difference from the one-manifold data. Test of the hydraulic system indicated that power requirements varied with wave steepness as well as wave length. Orifice area was a very important parameter as this affected the discharge requirements and the required size of supply piping. The power requirements of the pneumatic system are somewhat less than the hydraulic for average values of wave steepness, but the maximum attenuation achieved was less than the hydraulic. (Author)

Princeton U., N. J.
OBSERVATIONS ON LIQUID SHEETS FORMED BY COLLIDING VERTICAL JETS, by R. M. Koros, J. M. Deckers, and M. Boudart. Rept. on Contract AF 49(638)[32]. [1960] 61p. 14 refs. AFOSR-TN-60-234.
Order from LC mi$3.90, ph$10.80 PB 147 918

When two opposed vertical jets collide, a stable liquid sheet is formed. By measurements of conductivity, it was found that the thickness of the sheet at a distance from the jet axis is inversely proportional to L. Thus, the cross-sectional area to liquid flow and also the momentum of the liquid stay constant as the sheet spreads outward. There is, however, a loss of momentum of the fluid in the region of formation of the sheet. This loss is reflected by some mixing of the jets taking place in this region. Such liquid sheets have been used previously to study surface tension of freshly formed surfaces. The present work confirms the validity of the technique in the case of liquids with low viscosity.

Naval Ordnance Test Station, China Lake, Calif.
THEORETICAL LIFT AND DRAG ON VENTED HYDROFOILS FOR ZERO CAVITY NUMBER AND STEADY TWO-DIMENSIONAL FLOW, by Andrew G. Fabula. 4 Nov 59, 47p. 7 refs. NOTS TP-2360; NAVORD rept. 7005; AD-235 285.
Order from LC mi$3.30, ph$7.80 PB 146 988

Linearized, plane cavity-flow theory for steady, two-dimensional flow is used to predict lift and drag on hydrofoils with forced ventilation by gas exhaust on one side. Conditions assumed include cavity pressure equal to free-stream pressure, smooth separation of the free stream-lines, and infinite cavity length. Lift and drag coefficients are calculated versus exhaust point for several basic profile shapes, and formulas for lift, drag and moment coefficients are given for arbitrary profile.

Naval Ordnance Test Station, China Lake, Calif.
A METHOD FOR THE PRODUCTION OF UNIFORM BEADS OF CONTROLLED DENSITY IN THE DENSITY REGION CLOSE TO UNITY, by Arnold Adicoff. 8 Aug 59, 15p. NOTS TP 2308; NAVORD rept. 6580; AD-226 899.
Order from LC mi$2.40, ph$3.30 PB 148 448

A technique for the production of small spheres has been developed which consists primarily of forming the spheres in liquid nitrogen from a rubber latex, then coagulating these spheres in an ice-salt-acetic acid bath. The density of the spheres can be carefully controlled by the addition of a solid, more dense component to the latex prior to its coagulation. (Author)

Naval Ordnance Test Station, China Lake, Calif.
BASE-VENTED HYDROFOILS, by T. G. Lang. 19 Oct 59, 35p. 6 refs. NOTS TP-2346; NAVORD rept. 6606; AD-234 838.
Order from LC mi$3.00, ph$6.30 PB 146 987

Lift-producing hydrofoils that operate with a portion of the surface vented with gas were analyzed. The gas-covered surface is defined as the base. Results of the analysis show that a large number of different types of base-vented hydrofoils exist, some of which may have greater cavitation resistance and higher efficiency than the best of the fully wetted hydrofoils, provided, of course, that sufficient gas is available for venting. Other results show that a cambered base-vented hydrofoil having a parabolic cross section can operate near the surface without vapor cavitation, at speeds as much as 50% greater than those of fully wetted hydrofoils, and with little sacrifice in efficiency. Experimental tests on base-vented hydrofoils are needed to verify the results of this analysis (Author)

David Taylor Model Basin, Washington, D. C.
TESTS OF A PLANING BOAT MODEL WITH PARTIAL HYDROFOIL SUPPORT, by Peter Sherman. Aug 58, 25p. 7 refs. Rept. 1254; AD-205 320.
Order from LC mi$2.70, ph$4.80 PB 147 257

A model of a planing boat was equipped with two horizontal submerged hydrofoils which were designed to carry part of the weight of the craft. The foils were located forward of the center of gravity. Smooth-water resistance tests were made with foils at various fore-and-aft positions and various angles of attack to determine the optimum arrangement. Tests were also made of the foils alone. It was found that an appreciable scale effect on foil performance existed at Reynolds numbers below about 5×10^5. The data from the tests of the hull with foils, when corrected for scale effect on foil performance, indicated that the resistance of a planing boat can be decreased when such foils are added by as much as 27 1/2 percent. The best result was attained with the foils located at 28 percent of the hull length aft of the bow, and with the foil chord line at an angle of -3.5 deg with respect to the hull baseline. (Author)

METALLURGY

North American Aviation, Inc., Downey, Calif.
ELECTRODEPOSITION OF ALUMINUM ON MAGNESIUM, by E. W. Cooke and S. Kritzer. Rept. for 1 June 58-31 Mar 59 on Materials Applications, Contract AF 33(616)5854. Nov 59, 30p. 5 refs. WADC Technical rept. 59-465; AD-232 138.
Order from OTS $0.75 PB 161 892

This report describes detailed tests made to electrodeposit aluminum directly onto magnesium, using a modification of the non-aqueous bath developed by the National Bureau of Standards. The report shows that good adhesion is not obtained and a reaction occurs between the electroplating solution and magnesium. However, the report indicates that by using a zinc immersion intermediate coating, satisfactory adhesion is obtained. The purity of the aluminum deposited in this manner is greater than 99.8%, with low porosity. Good adhesion is also obtained on copper and steel. These coatings can be satisfactorily anodized. (Author)

Northwestern Technological Inst., Evanston, Ill.
SUBLIMATION OF SMALL SODIUM CHLORIDE SPHERES INTO ARGON, by D. H. Whitmore and J. B. Moser. Rept. on Contract AF 49(638)436. 15 Apr 60, 21p. 24 refs. AFOSR-TN-60-526.
Order from LC mi$2.70, ph$4.80 PB 148 210

The rate of vaporization of sodium chloride into an argon atmosphere was investigated over the temperature range 726° to 770°C using a hot-stage method to follow the change of radius of a small, subliming sodium chloride sphere. An integrated rate expression was derived for the present experimental conditions which showed the square of the radius of the volatile particle to be directly proportional to the time, the proportionality constant being both pressure and temperature dependent. In general, the pressure and temperature behavior of the empirical rate data is consistent with the proposed model which assumes that the vaporization rate is controlled by molecular diffusion of sodium chloride vapor away from the outer edge of a thin boundary layer adjacent to the surface of the sphere undergoing sublimation. (Author)

Office of Technical Services, Dept. of Commerce, Washington, D. C.
METAL COATINGS (1950-1960). May 60, 20p. 441 refs. OTS Selective Bibliography SB-409.
Order from OTS $0.10 OTS SB-409

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. Reports are arranged in sections as follows: metal coatings, general; electroplating; electropolishing; vapor deposition and vacuum deposition; phosphate coatings; plating.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
SINTERING ATMOSPHERES FOR BRASS COMPACTS, by R. A. Powell and F. I. Zaleski. Dec 59, 27p. Rept. R-1526; AD-233 880.
Order from LC mi$2.70, ph$4.80 PB 147 238

The highest tensile properties (26,000 psi tensile strength; 4 to 5 percent elongation) were obtained with 70-30 brass compacts sintered in covered boats with atmospheres that contained 80 to 100 percent hydrogen. The best tensile properties (18,000 psi tensile strength; 2 percent elongation) for the uncovered boat condition were obtained with the brass compacts sintered in atmospheres that contained 40 to 100 percent hydrogen. The zinc losses of the brass compacts decreased. Sintering in air or carbon monoxide resulted in high zinc losses and very low tensile properties.

Ferrous Metals

Battelle Memorial Inst., Columbus, Ohio.
THE MECHANISM OF HARDENING IN 17-7PH STAINLESS STEEL, by E. E. Underwood, A. E. Austin and others. Rept. for 15 May 59-14 May 60 on Kinetics of Internal Structural Changes, Contract AF 33(616)6521. June 60, 54p. 19 refs. WADD Technical rept. 60-236.
Order from OTS $1.50 PB 161 850

The unique hardening found in precipitation-hardening stainless steels was investigated both in commercial sheet alloys of 17-7PH and high-purity ferrite single crystals of Fe-17Cr-7Ni-2Al. Profuse precipitation of needle-shaped particles was responsible for maintaining the high hardness level in the aged crystals. Ordering was not detected by X-ray diffraction in severely quenched single crystals in which precipitation was suppressed. However, aged crystals displayed superlattice reflections from chromium and nickel on the bcc lattice, suggesting that the particles are ordered. Neutron-diffraction data indicate that the precipitate has an ordered bcc structure with iron on one sublattice and chromium, nickel, and aluminum distributed on the other sublattice. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
EVALUATION OF CAST ALLOYS FOR USE AT HIGH TEMPERATURES, by John Salvaggi. Final rept for 11 Dec 56-15 Dec 57 on Contract NObs-72224. [1958] 13p. 2 refs. Rept. no. KB-1137-M-4; AD-207 503.
Order from LC mi$2.40, ph$3.30 PB 148 242

Austenitic stainless steel compositions containing 17-20% chromium, 12-20% nickel, 2.5-5% molybdenum and 0.27-0.48% carbon were modified by additions of minor quantities of titanium, boron, columbium and tungsten and cast into test bars using the shell mold process. Several of these compositions displayed excellent high temperature strength properties, with 100-hour rupture stress values in the 24,000 psi range at 1500°F and 14,500 psi range at 1600°F being recorded. These high strengths were accompanied by adequate ductility values. Several ferritic heats were also prepared in the same manner and tested at 1200°F. The 100-hour rupture strength values obtained were comparable to those reported in the literature for several commercial stainless steels. However, extremely low ductility would make these alloys virtually unusable in their present condition. (Author)

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
IMPROVEMENT OF Cr-Ni-Mo IRON BASE ALLOYS BY VACUUM MELTING AND CASTING, by Franklin J. Gillig. Final rept. on Contract NObs-77019. 30 Sep 59, 16p. 6 refs. Rept. no. KA-1289-M-6.
Order from LC mi$2.40, ph$3.30 PB 148 243

The objective of this program was to investigate the effects of minor changes in composition and vacuum melting on the high temperature mechanical properties of iron base alloys containing 20 Cr- 20 Ni- 5 Mo and various minor additions of Cb, W, Ti, B and Al. Twenty-one heats were cast with varying compositions. The 100-hour rupture strength at 1500°F was used as the basis for rating the elevated temperature strength. The strength of the base line heat was not surpassed by any appreciable amount but equivalent strengths were obtained with several compositions that are leaner in alloying elements. (Author)

Illinois U., Urbana.
ON THE CRYSTALLOGRAPHY OF MARTENSITE: THE "{225}" TRANSFORMATION IN ALLOYS OF IRON, by C. M. Wayman, J. E. Hanafee, and T. A. Read. Rept. on Contract AF 49(638)420. [1960] 33p. 25 refs. AFOSR-TN-60-525.
Order from LC mi$3.00, ph$6.30 PB 148 874

For an accurate study of the transformation it is necessary that the martensite habit plane and orientation relationship for a single plate be determined. These observations are especially needed for the "{225}$_A$" transformation for which this determination had not previously been made. The presence of martensite sideplates was observed. The nature of these plates is uncertain at present. The findings point to the need for a microscopic examination of the austenite-martensite inferface.

Alloyd Corp., Cambridge, Mass.
RESEARCH ON TECHNIQUES FOR THE PRODUCTION OF ULTRA-PURE BERYLLIUM, by Malcolm Basche and Laurence M. Schetky. Rept. for 1 July 58-30 June 59 on Metallic Materials, Contract AF 33(616)5300. Mar 60, 55p. 18 refs. WADC Technical rept. 58-457, Pt. II.
Order from OTS $1.50 PB 161 877

Three techniques for making high purity Be were investigated: zone purification in moderate vacuum, distillation under high vacuum, purification through halide reduction of $BeCl_2$. Zone purification in vacuum proved to be impractical as a result of high Be vapor pressure. Distillation under high vacuum showed promise. Purification through halide reduction produced Be 99.6% and showed promise for improvement. (Author) (See also PB 151 878)

New York U. Coll. of Engineering, N. Y.
DEVELOPMENT OF A SINTERED TITANIUM POWDER BY VAPOR PHASE REACTION, by F. Ermanis, H. Margolin, and P. Herasymenko. Final rept. on Contract NOa(s) 58-101-d. 1 Dec 59, 15p. 8 refs.
Order from LC mi$2.40, ph$3.30 PB 147 256

A method for the production of sintered titanium composed of ductile titanium metal or its alloys and of a fine dispersion of insoluble titanium compounds. At present only a limited number of compounds are known which are insoluble in solid titanium at elevated temperatures. The most promising compounds appeared to be titanium phosphide with a solubility in α-titanium of less than .07% at 790°C, and titanium sulphide whose solubility in α-Ti is about .015% at 888°C.

New York U. Coll. of Engineering, N. Y.
THE TITANIUM ALUMINUM PHASE DIAGRAM, by E. Ence and H. Margolin. Final rept. on Contract DA 30-069-ORD-2164. July 59, 34p. 21 refs. OOR rept. 1939.2-ORD-Met.
Order from LC mi$2.40, ph$3.30 PB 148 428

Rodman Lab., Watertown Arsenal, Mass.
SOME PROPERTIES OF TITANIUM PROCESSED BY POWDER METALLURGY METHODS, by Francis S. DeLacey. Dec 59, 14p. 7 refs. Technical rept. no. RPL 41/10; AD-233 979.
Order from LC mi$2.40, ph$3.30 PB 147 233

The effect of compacting pressure and firing temperature variations on the tensile and shrinkage properties of titanium powder metal compacts was investigated. The effects of increasing the magnitude of compacting pressure were as follows: the tensile yield strength increased from 32,600 psi to 57,800 psi; the reduction of area increased from 3.2 to 18.6% and the volume shrinkage decreased from 4.86 to 1.99%.

Watertown Arsenal Labs., Mass.
AN ENGINEERING EVALUATION OF NOTCH SENSITIVITY IN HIGH STRENGTH SHEET MATERIALS. PHASE I. NOTCH TESTING. PHASE II. HYDRAULIC-BULGE TESTING, by George M. Orner and Carl E. Hartbower. Mar 60, 98p. 20 refs. Technical rept. no. WAL TR 405.1/1; AMC TR-60-7-662; AD-233 966L
Order from LC mi$5.40, ph$15.30 PB 147 235

The most economical test for notch sensitivity in high-strength sheet, in tough and moderately tough materials in thicknesses greater than about 0.040 inch, is the standard Charpy impact test. Commercially available annealed titanium sheet has good notch toughness properties at strength levels in the range 118 to 147 ksi. The feasibility of using an underwater spark discharge technique for bulge testing high-strength sheet materials at impact strain rates was investigated. Small bulges were produced in thin sheet materials; however, the electrical-mechanical efficiency of the system was too low to test sheet in heavier gages.

Watertown Arsenal Labs., Mass.
THE TRUE-STRESS TRUE-STRAIN PROPERTIES OF TITANIUM AND TITANIUM ALLOYS AS A FUNCTION OF TEMPERATURE AND STRAIN RATE, by Thomas S. DeSisto. Mar 60, 44p. 7 refs. Technical rept. no. WAL TR 405.2/4; AD-234 827.
Order from LC mi$3.30, ph$7.80 PB 147 276

True-stress true-strain properties of commercially pure titanium, Ti-7%Mn, Ti-5%Al - 2.5%Sn, and Ti-6%Al-4%V were obtained at temperatures of 800°F to -319°F at strain rates of 0.001, 0.01, and 0.1 inch per minute. For all materials tested, the flow stress increases with decreasing temperature and increasing strain rate, and the strain at fracture decreases with decreasing temperatures. The strain at maximum load decreases with increasing strain rate and decreasing temperature. An exception is shown by the commercially pure titanium where the strain at maximum load and fracture strain increase sharply with decreasing temperature. (Author)

Nonferrous (except light) Metals

Horizons, Inc., Cleveland, Ohio.
RATE OF DIFFUSION OF CARBON IN ALPHA AND IN BETA TITANIUM AS A FUNCTION OF THE TEMPERATURE AND CONCENTRATION, by Eugene Bucur and F. C. Wagner. Final technical rept., 12 Dec 52-1 July 54, on Contract DA 36-034-ORD-1157(RD). 24 Sep 54, 70p. 13 refs. WAL rept. no. 401/169-16.
Order from LC mi$3.90, ph$10.80 PB 148 039

The diffusion rates of carbon in titanium were determined over a range of temperature from 736°C to 1150°C. The activation energies were obtained by application of the Arrhenius type equation, $D = D_o e^{\frac{-Q}{RT}}$ and from a logarithmic plot of the diffusion coefficients versus the reciprocal of the absolute temperature; the values obtained for the alpha and beta temperature range are 43,500 cal/mole and 48,400 cal/mole respectively. By substituting the respective D_o value and Q value for the alpha or beta temperature range in the Arrhenius type equation the diffusion coefficient for a specific temperature can be calculated directly. The rate of diffusion of carbon in titanium is independent of concentration, or at most, very slightly dependent on concentration.

Naval Research Lab., Washington, D. C.
LOW TEMPERATURE DEPENDENCE OF THE ELECTRICAL RESISTIVITY AND THERMOELECTRIC POWER OF PALLADIUM AND PALLADIUM NICKEL ALLOYS CONTAINING ABSORBED HYDROGEN, by A. I. Schindler and R. J. Smith. Final rept. 3 June 60, 7p. 4 refs. NRL rept. 5481.
Order from LC mi$1.80, ph$1.80 PB 146 217

Electrical resistivity and thermoelectric power measurements have been made on a series of hydrogen-containing palladium and nickel-palladium alloys. It is known that a two-phase region exists at a hydrogen to palladium atom ratio of less than 0.6 while above this hydrogen concentration only a single-phase region exists. A resistivity maximum and, relative to pure palladium, a thermoelectric power minimum has been found at T = 50°K for the palladium-hydrogen samples containing $H/Pd \geq 0.58$. In addition a resistivity minimum has been found for these samples at approximately 90°K. At temperatures less than 80°K, the absolute thermoelectric power for Pd-H falls off rapidly as a function of composition in the vicinity of H/Pd = 0.6. However, at temperatures greater than 90°K a maximum is found in the absolute thermoelectric power at H/Pd = 0.6. (Author)

Office of Technical Services, Dept. of Commerce, Washington, D. C.
COLUMBIUM AND TANTALUM. June 60, 14p. 237 refs. OTS Selective Bibliography SB-414.
Order from OTS $0.10 OTS SB-414

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. Reports listed cover columbium and tantalum metals and alloys; carbides and compounds.

Office of Technical Services, Dept. of Commerce, Washington, D. C.
MOLYBDENUM AND TUNGSTEN. June 60, 18p. 390 refs. OTS Selective Bibliography 415.
Order from OTS $0.10 OTS SB-415

A bibliogrphy of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. Reports listed cover molybdenum and tungsten metals and alloys; carbides and compounds. These were added to the OTS collection during the period 1945 to July 1960.

Watertown Arsenal Labs., Mass.
THE CHROMIUM-COLUMBIUM BINARY SYSTEM, by John A. Misencik (Massachusetts Inst. of Tech.). Master's thesis. Mar 60, 45p. 5 refs. Technical rept. no. WAL TR 805.5/1; AD-234 510.
Order from LC mi$3.30, ph$7.80 PB 147 279

The complete binary system chromium-columbium has been developed, using metallographic, X-ray diffraction and thermal analysis techniques. The existence of beta-chromium has been confirmed and a eutectoid reaction, in the high chromium portion of the diagram, has been found at 1550°C, in addition to the eutectic reaction at 1660°C. The maximum solubility of columbium in chromium at 1500°C is 5 weight percent. The maximum solubility of chromium in columbium is 12 weight percent at 1500°C. The intermetallic compound at the stoichiometric ratio ($CbCr_2$) has been confirmed. (Author)

Structural Metallurgy and Corrosion

Arkansas U. Graduate Inst. of Tech., Little Rock.
POLARIZATION CAPACITANCE DETERMINATIONS OF SURFACE ROUGHNESS, by M. K. Testerman. Rept. on Surface and Interface Phenomena of Matter, Contract AF 33(616)5541. Apr 60, 39p. 24 refs. WADD Technical rept. 60-97.
Order from OTS $1.00 PB 161 847

Polarization capacitances of metallic surfaces are investigated in aqueous (0.5N KCl) and non-aqueous (0.18M KI-CH_3OH, 0.38M KI-$C_3H_5(OH)_3$, and 0.25M KI-$HCONH_2$) electrolytic systems. These systems are evaluated according to their general applicability for the determination of surface roughnesses. A pretreatment procedure is described for preparing an apparently deoxidized aluminum surface. Polarization capacitances obtained for copper, stainless steel, titanium, amalgamated copper, and pretreated aluminum surfaces are compared in the non-aqueous 0.25M KI-$HCONH_2$ system. Curves of capacitance versus applied polarizing potentials are depicted which indicate a high degree of dependency of double-layer capacitance on polarization potentials. Description of experimental procedure and apparatus is accompanied by explanatory figures and tables. (Author) (See also PB 151 268)

Arkansas U. Graduate Inst. of Tech., Little, Rock.
USE OF RADIOACTIVE IODINE VAPOR FOR DETERMINING SURFACE ROUGHNESS, by M. K. Testerman. Rept. on Surface and Interface Phenomena of Matter, Contract AF 33(616)5541. Dec 59, 48p. 25 refs. WADC Technical rept. 59-659.
Order from OTS $1.25 PB 161 844

Several relative roughness factors of gold, brass, and aluminum surfaces, exhibiting varying degrees of surface roughness, have been determined by utilizing I^{131} vapor as an adsorbate. Polished gold foil, possessing a high degree of purity, was used as a reference surface. A roughness factor of one was chosen arbitrarily for this reference surface, and all roughness factors contained herein are relative to this value. The roughness factors obtained for brass were decidedly higher than those obtained for other metals. Hence, it was concluded that a chemical combination resulted from the adsorbed layer of I^{131} on the brass surface accounting for the higher specific activity obtained. Figures and illustration describing the experimental equipment are given, as well as data tables and other information pertinent to the previously-mentioned roughness factors. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
OBSERVATIONS OF THE DEFORMATION OF ALUMINUM SUBJECTED TO IMPULSIVE LOADS OF CONSTANT MAXIMUM AMPLITUDE AND VARIABLE IMPULSE, by G. Moss and C. Glass. Apr 60, 11p. 3 refs. Technical note no. 1310.
Order from LC mi$2.40, ph$3.30 PB 148 514

A study was made of the strain of four crystallographically identical aluminum samples, each of which had been subjected to an impulsive load applications were cylindrically symmetrical so that strictly hydrodynamic behavior of the aluminum during plastic deformation would have resulted in craters with round cr~ss sections. Actually, the craters developed were as nearly square as they were round. Hence, it was concluded that aluminum deforms by the usual mechanisms even when subjected to the extreme stress levels used in this work, i.e. 270 kilobars. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
STUDIES OF THE DEFORMATION MECHANICS OF AN IMPULSIVELY LOADED COPPER SINGLE CRYSTAL, by G. Moss and C. Glass. Apr 60, 15p. 4 refs. Memo. rept. no. 1257. AD-237 578.
Order from LC mi$2.40, ph$3.30 PB 148 512

A copper single crystal which had been internally loaded with an explosion was recovered, and the mechanism by which it deformed at the metal-explosion interface was established as slip on {111} planes, probably in <110> directions. This is the mechanism by which copper commonly deforms when stressed with nonimpulsive loads. Hence, it is concluded that the final deformation of copper due to explosively applied loads with initial pressures of approximately 400 kilobars is influenced by the metal strength and structure. This is in contrast with the usual treatments of explosively induced strain, which are based on the assumptions that metal strength is negligible relative to the explosive load and that deformation can be treated as an entirely hydrodynamic process. (Author)

Cornell Aeronautical Lab., Buffalo, N. Y.
EFFECTS OF CONCENTRATED HYDROGEN PEROXIDE ON MECHANICAL AND CORROSION PROPERTIES OF STRUCTURAL ALUMINUM ALLOYS, by Franklin J. Gillig. Final rept. on Contract NObs-72258. 16 Feb 59, 64p. Rept. no. KC-1164-M-11; AD-214 856.
Order from LC mi$3.90, ph$10.80 PB 148 376

Nine wrought and three cast aluminum alloys were exposed to commercial 90% H_2O_2 as manufactured and 90% H_2O_2 with 3 grams per liter chloride ion and 4 grams per liter nitrate ion added. The majority of the exposures were of 6 months duration. Some of the specimens had to be removed prematurely due to

severe corrosion or rapid deterioration of the peroxide. Evaluation tests included mechanical properties, stress corrosion, metallographic examination and chemical analyses of the peroxide in order to determine its deterioration. The presence of chloride ion was found to accelerate corrosion greatly in all of the alloys. Wrought alloys 5254 and 3003 were found to be the most compatible and B-214 was the best cast alloy. (Author)

Crucible Steel Co. of America, Pittsburgh, Pa.
CORROSION OF SUPERALLOYS BY SELECTED FUSED SALTS, by A. Moskowitz and L. Redmerski. Rept. for 15 Mar 59-15 Feb 60 on Finishes and Materials Preservation, Contract AF 33(616)6196. Mar 60, 84p. 30 refs. WADD Technical rept. 60-115.
Order from OTS $2.25 PB 161 848

The corrosion of Inconel X, Inconel 702, Rene 41, M-252, and Haynes 25 by potassium chloride and lithium fluoride at 1600 to 1900 F was studied. Thin coatings of the salts (1.5 mg/cm^2) caused severe corrosion of the alloys in air, which resulted in accelerated failures of thin sheet specimens in creep-rupture testing. Rankings for the alloys based on creep-rupture tests were similar for uncoated and salt-coated materials: Haynes 25, Rene 41, and M-252 best, Inconel 702 poorer, and Inconel X poorest. The corrosion products consist of oxides and spinels and only very little corrosion, if any, occurs without oxygen. The presence of the salt prevents the normal formation of a protective oxide film. X-ray diffraction studies showed differences between the normal oxidation products and the oxide corrosion products produced with salt present. The corrosion occurs as severe surface attack with consequent eroding away of metal, as intergranular penetration, and as internal voids formed in the alloy. All of the alloys were susceptible to each of these types of corrosion. Grain boundary separation effects due to stress (2,500 to 10,000 psi) were also found. (Author

Crucible Steel Co. of America, Syracuse, N. Y.
DEVELOPMENT OF A DUCTILE, OXIDATION-RESISTANT AND HIGH STRENGTH SINGLE-PHASE (AUSTENITIC) ALLOY BASED ON Fe-Al-Mn-C SYSTEM, by R. C. Gibson. Bimonthly progress rept. no. 2, 15 Dec 59-15 Feb 60, on Contract NOas-60-6025-c. 21 Mar 60, 14p.
Order from LC mi$2.40, ph$3.30 PB 148 003

Work was initiated to develop a ductile, oxidation-resistant and high strength alloy based on the Fe-Al-Mn-C system for use at intermediate temperatures (1100 to 1400 F). Results of heat treating studies performed on an Fe-Al-Mn-C-Mo-W-V base alloy containing additions of copper and nickel have revealed that copper has little or no effect on the hardness of the alloys when aged in the temperature range 1100 to 1400 F. Nickel, however, was observed to significantly increase the hardness of the alloys during aging at these same temperatures (1100 to 1400 F). Based on hardness data, there is no apparent interaction between copper and nickel which affects the aging characteristics of the alloy. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
PHYSICAL PROPERTIES OF SOME NICKEL-BASE ALLOYS, by M. E. Langston and C. H. Lund. Rept. on Contract AF 18(600)1375. 20 May 60, 137p. 83 refs. DMIC rept. 129.
Order from OTS $2.75 PB 151 086

The available physical properties of 33 nickel-base alloys are tabulated along with their respective chemical compositions and a brief general description of each alloy, its uses, and available forms. The 33-representative alloys are divided into the following six groups: Group I. Nickel-Copper; Group II. Nickel-Silicon; Group III. Nickel-Chromium; Group IV. Nickel-Chromium-Iron; Group V. Nickel-Chromium-Cobalt; Group VI. Nickel-Molybdenum.

General Electric Co., Cincinnati, Ohio.
DEVELOPMENT OF HIGH STRENGTH MATERIALS FOR SOLID ROCKET MOTORS, by E. N. Bamberger. Annual rept. on Contract NOrd-18119, Tasks I and II. 31 May 59, 136p. R59FPD303.
Order from LC mi$6.90, ph$21.30 PB 148 927

Illinois U., Urbana.
THE EFFECTS OF INELASTIC ACTION ON THE RESISTANCE TO VARIOUS TYPES OF LOADS OF DUCTILE MEMBERS MADE FROM VARIOUS CLASSES OF METALS. PART XII. ECCENTRICALLY-LOADED TENSION MEMBERS AND COLUMNS MADE OF 17-7PH STAINLESS STEEL AND Ti 155A TITANIUM ALLOY AND TESTED AT VARIOUS TEMPERATURES, by Q. M. Sidebottom, S. Dharmarajan and others. Rept. on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5658. Feb 60, 84p. 11 refs. WADC Technical rept. 56-330, Pt. XII.
Order from OTS $2.25 PB 161 836

Experimental data were obtained from eccentrically-loaded columns made of 17-7PH stainless steel and Ti 155A titanium alloy and tested at room temperature, from eccentrically-loaded columns made of 17-7PH stainless steel and tested at 1000°F, and from eccentrically-loaded tension members and columns made of Ti 155A titanium alloy and tested at 800°F. In most cases the creep tests were limited to 30 min. At the elevated temperatures the inelastic deformation was time dependent for the 17-7PH stainless steel and was mostly time independent for the Ti 155A titanium alloy. The theoretical analysis of room temperature tests data obtained from Ti 155A titanium alloy members tested at 800°F was based on the interaction curve-moment-load curve theory. The arc hyperbolic sine theory was used in the analysis of data obtained from 17-7PH stainless steel members tested at 1000°F. In all cases good agreement was found between theory and experiment. (Author) (See also PB 161 303)

Ingersoll Kalamazoo Div., Borg-Warner Corp., Mich.
AN INVESTIGATION OF THE RELATIVE DEFORMATION OF VARIOUS METALS BY CONCUSSION FORMING METHODS, by Don May. Rept. on Contract NOrd-15719. 6 July 59, 94p. 1 ref. Project rept. # SPDIR 20; AD-218 491.
Order from LC mi$5.40, ph$15.30 PB 148 461

The most extensive investigation centered around AISI 4130. Lesser amounts of work were done with AISI 1020, Vascojet 1000, MBMC #1, aluminums 2024-0, 2024-T and 6061-T. Tetryl, the properties of which are included in the main body of the report, was used as the explosive throughout the investigation. The effect of concussion forming on the hardness, thickness and grain structure of typical specimens is reported. The relationship between explosive charge size and the amount of specimen deformation is presented for several materials and conditions. The relationship between material thickness and the amount of specimen deformation is presented for several materials at various conditions. The relationships between the proximity of the explosive charge to the work piece and the amount of deformation are presented for several materials and conditions. The relationship between yield strength and specimen deformation is given for different materials and conditions. A minimum investigation into the feasibility of forming hemispheres at a single detonation was conducted. (Author)

Massachusetts Inst. of Tech., Cambridge.
THE EFFECTS OF STORED ENERGY AND RECRYSTALLIZATION ON THE CREEP RUPTURE PROPERTIES OF INTERNALLY OXIDIZED COPPER-ALUMINA AND COPPER-SILICA ALLOYS, by Masao Adachi and Nicholas J. Grant. Rept. for 1 Sep 58-1 Sep 59 on Solid State Research, Contract AF 33(616)5424. Dec 59, 27p. 9 refs. WADC Technical rept. 59-777.
Order from OTS $0.75 PB 161 846

Copper-silica and copper-alumina alloys of low oxide content were produced by the internal oxidation and extrusion of copper-silicon and copper-aluminum alloy powders. These alloys show normal behavior after recrystallization. With increasing amounts of recrystallization at temperatures up to 1050°C, the creep rupture strength at 450°C decreases and the ductility increases. Cold work of the partially or completely recrystallized alloys results in an increase in creep rupture strength and a decrease in ductility. The strength of dispersed oxide hardened alloys of this kind is due to a combination of micron or sub-micron dispersion of an insoluble oxide and a high value of stored energy through cold work. In the as-extruded condition, both the dispersion and the cold work impede the dislocation movements. After recrystallization the only impediment to dislocation movement is the oxide dispersion. Improved ductility and higher creep rates are a result. (Author)

Massachusetts Inst. of Tech., Cambridge.
STABILIZATION OF THE MARTENSITIC TRANSFORMATION IN IRON-NICKEL ALLOYS, by John Woodilla, P. G. Winchell (Purdue U.) and Morris Cohen. Technical rept. no. 2 on Contract Nonr-1841(35). 15 Sep 59, 8p. 7 refs. AD-226 382.
Order from LC mi$1.80, ph$1.80 PB 148 565

An isothermal mode of the martensitic reaction was employed to derive the activation energy for stabilization. An Fe-Ni alloy with 30.8 wt-% Ni and 0.007 wt-% C, and in the form of rods 0.074 in. in diameter and 2 1/2 in. long were used. The specimens were sealed in evacuated Vycor tubes and austenitized at 1100°C for one-half hour prior to quenching in water. One series of specimens was decarburized (and denitrogenized) prior to the austenitizing treatment by annealing in moist H for 182 hr at 1215°C. All the specimens were transformed to martensite by cooling to -195°C before final austenitizing. Both the 0.007% C and the decarburized series then had an M_s temperature of about -30°C. The isothermal martensitic transformation was conducted at a reference temperature of -88°C, and was traced by means of electrical resistance measurements. The rate of decrease of the resistance ratio ($-dR/_{dt}$) provided a measure of the transformation rate. The stabilization treatment was introduced by up-quenching from the reference temperature to a stabilizing temperature between 0° and 22°C. In the hydrogen-annealed series, the extent of transformation during the stabilizing cycle was usually larger than in the 0.007% C series; some martensite actually formed at the stabilizing temperature as well as during the quench back to the reference temperature. The decarburized specimens displayed no sign of stabilization; this established C and/or N as the controlling agent for the stabilization phenomena.

Materials Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
ELECTRON MICROSCOPY OF ETCH PITS, by Richard E. Pawel. Rept. for Mar 58-Dec 58 on Materials Analysis and Evaluation Techniques. Oct 59, 29p. 9 refs. WADC Technical rept. 59-68; AD-231 280.
Order from OTS $0.75 PB 161 838

An advanced electron microscopic technique has been developed which uses etch pits to delineate the crystalline structure and orientation of single grains of polycrystalline copper, brass and aluminum. In addition this method has been extended to permit the study of the deformation of these materials using the direction and the extent of slippage of the slip lines to indicate the local deformation on a microscale. Suitable chemical etching and replication techniques were developed for these materials in the course of this study. (Author)

Material Labs., Puget Sound Naval Shipyard, Bremerton, Wash.
PRESERVATION OF WATER LUBRICATED PROPULSION SHAFT BEARINGS ON WATERBORNE VESSELS WITH RUBBER BOOT SEALS HAVING BROKEN STAINLESS STEEL CABLES, by W. B. Lew, L. N. Schultz, and L. B. Blakney. Oct 56, 24p. Rept. R-331; AD-125 965.
Order from LC mi$2.70, ph$4.80 PB 146 387

A special case is presented for preserving propulsion shaft, strut and stern tube, water lubricated bearings on waterborne vessels. Divers were required to replace the broken stainless steel cables with Monel cables. All the rubber boot seals were filled with fresh sodium chromate solution. Report covers the installations on the inactivated vessels, USS WRIGHT, USS PITTSBURGH, and USS BALTIMORE.

Minerals Research Lab., U. of California, Berkeley.
STUDIES OF ALLOY THERMODYNAMICS BY LIQUID TIN SOLUTION CALORIMETRY, by Raymond L. Orr and Ralph Hultgren. Final rept. for 1 Nov 53-31 Oct 58 on Study of Atomic Bonding Forces in Alloys, Contract DA 04-200-ORD-171, T. O. 8. 1 Apr 60, 16p. 26 refs. Series no. 76, issue no. 13; OOR rept. 906.14-Met.
Order from LC mi$2.40, ph$3.30 PB 148 433

A liquid tin solution calorimeter capable of accurate measurements of alloy heats of formation as well as other types of thermodynamic measurements has been developed and applied to the thermodynamic study of a number of alloy systems. The accomplishments of this study have been reviewed mainly by reference to previous technical reports and published papers which have been submitted. The technical reports, published papers, and graduate theses resulting from this research are listed, and an evaluation is made of the progress made.

Rock Island Arsenal Lab., Ill.
STORAGE STABILITY OF PETROLATUM TYPE CORROSION PREVENTIVE COMPOUNDS, by Linden H. Wagner. 28 Apr 60, 36p. 10 refs. Rept. no. 60-1366.
Order from LC mi$3.00, ph$6.30 PB 148 365

Commercially formulated petrolatum base corrosion preventive compounds consisting of six Class 1A, three Class 2, and five Class 3, qualified under Military Specification MIL-C-11796A, "Corrosion Preventive, Petrolatum, Hot Application", were stored indoors in bulk containers. They were evaluated for storage stability throughout a five year period in accordance with the test requirements of Specification MIL-C-11796A. Infrared absorption spectra were determined simultaneously during the storage period for comparative purposes. Additional coated test panels were exposed in outdoor and shed storage exposure to determine the effect of prolonged weathering after 12, 15, 18, 21 and 24 months. The stability of the compounds varied so that no assurance can be given that products qualified against the specification will continue to be satisfactory beyond approximately three years when placed in storage. (Author)

Watertown Arsenal Labs., Mass.
A MECHANICAL PROPERTY FORECASTER FOR TITANIUM ALLOYS, by C. F. Hickey, Jr. and L. S. Croan. Sept 59, 16p. 2 refs. Technical rept. no. WAL TR-405.21/2; AD-227 130.
Order from OTS $0.50 PB 161 018

An investigation was conducted to determine if the mechanical properties of heat-treated titanium alloy forgings in various upset thicknesses can be forecasted by using thin test coupons. All upset discs were the product of the same bar and each was reduced by an equal percentage during upsetting. Ti-6%Al-4%V was selected for test material because of its widespread use as a commercial alloy. Results of the study indicate that mechanical properties of the heavier sections can be forecasted by duplicating their cooling rates in the thin upset test coupon. (Author)

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Ecole Normale Supérieure (France).
THE AXIAL VECTOR CURRENT IN BETA DECAY, by R. P. Feynman (California Inst. of Tech.) M. Gell-Mann, and M. Lévy. Technical note no. 17 on Contract AF 61(052)173. [1960] 30p. 20 refs. AFOSR-TN-60-294; AD-234 428.
Order from LC mi$2.70, ph$4.80 PB 146 551

In order to derive in a convincing manner the formula of Goldberger and Treiman (Phys. Rev. 110:1478, 1958) for the rate of charged pion decay, the possibility is considered that the divergence of the axial vector current in β decay may be proportional to the pion field. Three models of the pion-nucleon interaction (and the weak current) are presented that have the required property. The first, using gradient coupling, has the advantage that it is easily generalized to strange particles, but the disadvantages of being unrenormalizable and of bringing in the vector and axial vector currents in an unsymmetrical way. The second model, using a strong interaction proposed by Schwinger and a weak current proposed by Polkinghorne, is renormalizable and symmetrical between V and A, but it involves postulating a new particle and is hard to extend to strange particles. The third model resembles the second one except that it is not necessary to introduce a new particle. (Renormalizability in the usual sense is then lost, however). (Author)

Institute of Theoretical Physics, Stanford U., Calif.
COUPLED INTEGRAL EQUATIONS FOR THE NUCLEON AND PION ELECTROMAGNETIC FORM FACTORS, by M. Baker and F. Zachariasen. Technical note no. 10 on Contract AF 49(638)388. Feb 60, 47p. 5 refs. AFOSR-TN-60-184; AD-233 730.
Order from LC mi$3.30, ph$7.80 PB 147 334

The dispersion relations for the nucleon isotopic vector form factors and the pion form factor which take into account contributions from both the 2π and NN intermediate states become a set of coupled integral equations for the form factors if the four amplitudes $(\pi\pi|NN)$ $(\pi\pi|\bar{\pi}\pi)$ $(NN|\pi\pi)$ $(NN|\bar{\pi}\pi)$ are assumed known. If these 4 amplitudes are replaced by their Born approximation values and spin and certain kinematic factors are neglected, the resulting set of coupled singular integral equations can be solved exactly. Comparison of these exact solutions with the form factors obtained from the usual approximation of retaining only

the lowest mass state (i.e. the 2π state) confirms the hope that high mass states do not contribute much to dispersion integrals. It is also of interest that these solutions are obtained from dispersion relations without subtractions and satisfy the necessary conditions that they vanish at infinite momentum transfer and take on the value at the origin for all values of the coupling parameters appearing in the equations. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
NUCLEON STRUCTURE AND ELECTROMAGNETIC INTERACTION: THEORY, by L. I. Schiff. Technical note no. 3 on Contract AF 49(638)388. July 59, 29p. AFOSR TN-59-900; AD-226 977.
Order from LC mi$2.70, ph$4.80 PB 146 471

Presentation is in four parts. (1) A consideration of corrections to the single-virtual-photon approximation that can arise in electron scattering processes. (2) Information on nucleon form factors obtainable from experiments involving polarized particles, and from pion production. (3) Theory of the nucleon form factors. (4) Possible breakdown of quantum electrodynamics at small distances. (To be published in the Proceedings of the 9th International Conference on High-Energy Physics, Kiev, USSR, July 1959.)

Maryland U., College Park.
DETERMINATION OF K^+-n P-WAVE PHASE SHIFTS FROM K^+-d REACTIONS, by T. B. Day, L. S. Rodberg and others. Rept. on Contracts AF 49(638)24 and AT(40-1)2504. Mar 60, 11p. 6 refs. Physics Dept. technical rept. no 166; AFOSR-TN-60-306; AD-234 300.
Order from LC mi$2.40, ph$3.30 PB 146 642

Michigan U. Research Inst., Ann Arbor.
COSMIC RAY INVESTIGATIONS. Annual progress rept. on Contract Nonr-1224(07). 15 June 59, 6p. AD-218 102.
Order from LC mi$1.80, ph$1.80 PB 147 261

Naval Radiological Defense Lab., San Francisco, Calif.
OXIDATION STATES OF U^{237} AND Np^{239} IN UNDERWATER BURST DEBRIS, by S. C. Foti and E. C. Freiling. 24 Sep 59, 16p. 13 refs. Research and development technical rept. USNRDL-TR-370; AD-231 331.
Order from LC mi$2.40, ph$3.30 PB 147 940

A procedure is described which separates the U and Np present in seawater into their various oxidation states. Application of the procedure to ultrafiltrates of surface water samples from an underwater burst and a lagoon bottom burst is described. Results are presented as a function of time and correlated with physical state distributions made on the same samples. (Author)

California U., Berkeley.
X-RAY YIELDS FROM u-MESONIC ATOMS, by M. A. Ruderman. Rept. on Contract AF 49(638)327. Dec 59, 38p. 23 refs. AFOSR-TN-60-118; AD-233 715.
Order from LC mi$3.00, ph$6.30 PB 146 745

The interesting suggestion was made that the rapid drop in the yield of K X-rays in the light elements may be associated with the capture of μ-mesons into the metastable 2s-state. The mechanisms for making transitions from the 2s to the 1s state and from various ρ-states into the 2s state were investigated in detail for Li, Be and B. It is found that the paradoxical reduction of K X-rays remains unexplained.

Cambridge U. (Gt. Brit.)
LOW ENERGY PION PHENOMENA, by J. Hamilton and W. S. Woolcock. Scientific note no. 2 on Contract AF 61(052)233. Oct 59, 33p. 43 refs. AFOSR-TN-59-1314. AD-234 215.
Order from LC mi$3.00, ph$6.30 PB 146 739

The relation between low energy pion-nucleon scattering and pion photo-production is examined. Correct extrapolation to threshold of both the π^+ and π^- photoproduction data gives agreement with theory. A recent new method for analysing the scattering data is applied, giving $a_1 = 0.178$, $a_3 = -0.87$, and reasonable agreement with the Panofsky ratio $P = 1.5$ is obtained. An inner Coulomb correction to the scattering data helps to improve this agreement. The possibility of detecting a π-π interaction by low energy pion scattering is examined. A new dispersion relation connects the s- and p-wave phase shifts at low energies; this relation excludes some well known sets of phase shift curves. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
UPPER BOUNDS ON SCATTERING LENGTHS FOR STATIC POTENTIALS, by Larry Spruch and Leonard Rosenberg. Rept. on Contract AF 19(604)4555. Oct 59, 34p. 25 refs. Research rept. no. CX-43, AFCRC-TN-59-669; AD-233 305.
Order from LC mi$3.00, ph$6.30 PB 146 566

It is shown that in the zero energy scattering of a particle by a center of force, where no bound state exists, the Kohn variational principle provides an upper bound on the scattering length. A bound may also be obtained from Hulthén's method, although with the same form of trial function the Kohn result will be lower (and therefore better) than the one obtained from the Hulthén principle. The Rubinow formulation need not provide a bound; for those calculations which have been performed in this form, the results may be converted without any further calculations so that they correspond to the Kohn form, and therefore, under the circumstances considered, do give a bound. Analogous results hold for states of non-zero orbital angular momentum. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
HIGH ENERGY ELECTRON-ELECTRON SCATTERING, by Yung-Su Tsai. Technical note no. 16 on Contract AF 49(638)388. May 60, 69p. 26 refs. AFOSR-TN-60-546.
Order from LC mi$3.90, ph$10.80 PB 148 163

The radiative corrections to the electron-electron scattering to order α^3 are calculated for (1) the colliding beam experiment and (2) the experiment in which the target electron is at rest initially. The contributions from high energy real photons are included. The two photon exchange diagrams are found to give only negligible contributions to the cross sections after infrared cancellation. The effect due to the possible breakdown of quantum electrodynamics is discussed. A preliminary study on the electron-positron colliding beam experiment involving various interactions is made. The vacuum polarizations involving heavier particles than an electron pair in the closed loop are investigated. (Author)

Maryland U., College Park.
ON THE DECAY INTERACTION OF STRANGE PARTICLES, by B. Sakita (U. of Wisconsin) and S. Oneda. Rept. on Contract AF 49(638)24. Feb 60, 16p. 20 refs. Physics Dept. Technical rept. no. 165; AFOSR-TN-60-304; AD-234 727.
Order from LC mi$2.40, ph$3.30 PB 147 443

It is proposed that the strength of the coupling constants is different for the strangeness non-conserving and strangeness conserving currents in the scheme of Fermi interactions of an ordinary charged current-current type. First, the consistency with experimental results is analyzed by introducing phenomenologically the direct Λn interaction which satisfies the $|\Delta I| = 1/2$ rule in addition to the usually assumed primary Fermi interaction. Then, the possibility of the derivation of this interaction as the effective interaction of the primary Fermi interactions is discussed. (Author)

New York U. Coll. of Engineering, N. Y.
A THOMAS-FERMI TECHNIQUE FOR DETERMINING CHARACTERISTICS OF ALKALI ATOMS WITH EXCITED VALENCE ELECTRONS, by Harvey J. Brudner. Technical rept. no. 4 on Contract Nonr-285(15). 1 July 59, 147p. 78 refs. AD-228 163.
Order from LC mi$7.20, ph$22.80 PB 146 968

A technique is developed for the calculation of excited state, one-electron wave functions which is based on the Thomas-Fermi statistical theory of the atom. The case most immediately applicable to calculation via a Thomas-Fermi technique is that of an alkali atom with an excited valence electron since the remaining electrons form a full, symmetric core, all of whose electrons are in the ground state. The technique developed allows for correction for the penetration of the excited electron's wave function, and for semi-empirical correction of polarization and exchange effects. A special, very accurate, numerical technique for solving the Thomas-Fermi differential system for an arbitrary positive ion is described. The Thomas-Fermi potential is then used as a central field in the Schrödinger equation together with the Heisenberg type of polarization energy correction. Angular dependence is assumed to be capable of separation (an approximation also made in Hartree theory), and 2 basic techniques for solving the radial Schrödinger equation are discussed. (Author)

Nuclear Development Corp. of America, White Plains, N. Y.
CONTINUUM THEORY OF GAMMA RAY SPECTRA FOLLOWING INELASTIC SCATTERING, by E. S. Troubetzkoy. Final rept. for 17 Dec 58-30 Sep 59 on Contract DA 18-108-405-cml-295. 1 Nov 59, 12p. NDA 2111-3, Vol. B; AD-233 928.
Order from LC mi$2.40, ph$3.30 PB 146 778

A theory predicting gamma-ray spectra following inelastic scattering of fast neutrons is derived on the basis of the continuum model. The problem is reduced to integrals over the solution of a fourth order differential equation. (Author)

Weizmann Inst., of Science (Israel).
RESEARCH ON THE INTERACTION OF VERY HIGH ENERGY COSMIC RAY PARTICLES. Technical final rept. for 1 Apr 58-30 Sep 59 on Contract AF 61(052)58. [1959] 40p. 32 refs. AFCRC-TR-60-214
Order from LC mi$3.00, ph$6.30 PB 146 706

The work performed under this contract is reported in three sections: The Excited Nucleons' Model of Meson Production. On the Radiation of Mesons with a Constant Transverse Momentum P_T in Cosmic Ray Jets. Nuclear Interaction of Heavy Cosmic Ray Particles in Photographic Emulsion.

Instruments and Installations

Armour Research Foundation, Chicago, Ill.
RESEARCH ON SCINTILLATION CRYSTALS AND THEIR ACTIVATORS. I. ZONE MELTING AND ZONE LEVELING OF LiI(Tl). II. COMPACTION AND ACTIVATION OF SCINTILLATORS. III. EFFECT OF COLOR CENTERS ON THE SCINTILLATION OF KI(Tl), by Harold V. Watts, Robert H. Bragg and others. Rept. for 1 June 56-14 May 58 on Contract AF 33(616)3748. July 58, 67p. 17 refs. WADC Technical rept. 58-380; AD-155 861.
Order from OTS $1.75 PB 161 870

In the preparation and growth of impurity activated inorganic scintillators one faces the problems of undesirable impurities in the starting material and of difficulties in many host-activator systems in maintaining uniform activator concentration over reasonable distances. The techniques of zone melting and zone leveling were applied to the preparation of thallium activated lithium iodide. Lithium iodide was successfully purified by zone melting; and a thallium doped ingot prepared by zone leveling the pure lithium iodide was found to be a scintillator of optimum pulse height with a uniform thallium concentration, maintained for about half of the total ingot length of eight inches. Many of the problems of production of scintillators by crystal growth methods may be by-passed by the successful application of the high pressure compaction

technique to the production or scintillators. The compaction technique allows the usage of diverse activatior methods in the preparation of scintillators. Some of these methods have been investigated. Since the creation and ionization of color centers are processes which compete with scintillation for the energy absorbed from the impinging nuclear radiation, a correlation of luminescence characteristics versus color center concentrations was studied to gain insight into the details of the influence of defects in scintillators.

Army Chemical Warfare Labs., Army Chemical Center, Md.
A PORTABLE LOW-LEVEL ALPHA COUNTER FOR FIELD USE, by Arthur Lind and John C. Goshorn, Jr. Mar 60, 13p. CWLR-2378.
Order from LC mi$2.40, ph$3.30 PB 148 228

A proportional-probe alpha-survey meter (Nuclear Chicago model 2111) has been modified into an enclosed-chamber-type alpha counter, using a multiplier-phototube, alpha scintillator, and a housing designed to accept swipes. The modified instrument is both reliable and sensitive enough to detect very low levels of alpha contamination. The major improvement in reliability is the elimination of the air probe which was subject to high-voltage leakage and microphonics. (Author)

Materials Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
ATTEMPT TO EVALUATE CHLORINATED HYDROCARBON DOSIMETERS BY CROSS CALIBRATING ELEVEN GAMMA RAY SOURCES, by Robert L. Hickmott, Maurice J. Cote, and Philip B. Hemmig. Rept. for Mar 58-Nov 59 on Materials Analysis and Evaluation Techniques. Nov 59, 18p. WADC Technical note 59-401.
Order from OTS $0.50 PB 161 875

An evaluation of the chlorinated hydrocarbon dosimetry system of Convair, Fort Worth was attempted. The evaluation consisted of two phases. The first phase tested the precision of the dosimetry system. It involved the irradiation of thiry five single dosimeters at WADC. The second phase was intended to field test the dosimetry system. It was also hoped that data from this phase would permit the cross calibration of the participating facilities. Data obtained in this program is presented with an analysis of the results. (Author)

Materials Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
OPTICALLY ACTIVE ORGANIC COMPOUNDS AS HIGH LEVEL GAMMA DOSIMETERS, by Stanley M. Dec. Rept. for Aug 58-June 59 on Materials Analysis and Evaluation Techniques. Feb 60, 39p. 9 refs. WADC Technical rept. 59-711.
Order from OTS $1.00 PB 161 881

This project was initiated in order to develop a dosimeter system which could extend the range of current dosimeter methods. A new technique was used, wherein the effects on the rotation of optically active organic compounds were determined with gamma radiation. Data was presented for fourteen optically active compounds. Several potential dosimeter systems were uncovered indicating linear, or near linear response in the degradation of optical activity as a function of total gamma dose up to 4×10^{10} ergs $gram^{-1}$ carbon. Further investigation is recommended to develop the systems. Calibration, reproducibility, sensitivity to impurities, dose rate dependence, and irradiation to higher dose levels are factors which should be considered. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
RECYCLING DOSERATE METER RGI-20, by E. J. Wesley and T. L. Sheridan. 18 May 59, 29p. 2 refs. Research and development technical rept. USNRDL-TR-323; AD-220 474.
Order from LC mi$2.70, ph$4.80 PB 148 372

A hybrid tube plus transistor blocking oscillator system was adapted to a high range gamma doserate meter for disaster survey applications. The instrument features single battery operation, a hermetically sealed input consisting of the ion chamber detector and electrometer tube, and low impedance range switching at the meter. Included is a summary of the design criteria and formulas for both the ion chamber detector and the recycling circuit, with particular reference to the mechanism of compensation for battery voltage and ambient temperature changes. The calibration setting for the instrument is maintained within 5% for battery voltage drift from 1.5 to 1.1 v and temperature changes from 55°C to -40°C. (Author)

Nuclear Science and Engineering Corp., Pittsburgh, Pa.
OPERATION AND MAINTENANCE MANUAL. 8-COUNTER LOW BACKGROUND NUCLEAR RADIATION MEASUREMENT SYSTEM. Final rept. on Contract AF 19(604)3874. 18 Jan 60, 54p. AFCRC TR-60-112; AD-233 727.
Order from LC mi$3.60, ph$9.30 PB 146 382

The 8-counter low-background nuclear radiation measurement system is a device designed to measure minute quantities of radioactivity. Each counter is independent of the other counters, both electronically and mechanically, so that the individual sample changes may be made in any counter without disturbing operation of the other counters. Thus, in addition to providing a means of measuring levels of radioactivity that are not easily measured by conventional detection devices, the system provides for efficient use of the equipment by allowing eight samples to be counted at one time for the relatively long counting periods required to obtain a statistically sufficient number of counts. (Author)

Combustion Engineering, Inc., Windsor, Conn.
OXYGEN REMOVAL FROM REACTOR WATER BY A COPPER AMMINE COMPLEX EXCHANGE RESIN, by A. S. Powell and E. V. Falcone. Rept. on Contract DA 44-192-eng-11.18 Dec 59, 13p. 5 refs. CEND/2407/RS/68.
Order from LC mi$2.40, ph$3.30 PB 147 042

Tests of a copper ammine complex exchange resin were made by flowing either air or oxygen-saturated water through a 30 in. long glass column containing 0.00018 ft.^{3} (50 ml) of the resin at the start of each test. Water flows of 6, 8 and 12 gpm/ft.^{3} (41.6, 55.5 and 83.3 ml/min) at 120, 150, 175 and 200°F and pH's 6, 7 and 8 were used. Oxygen in inflowing water was determined by the Winkler method; that in water leaving the bed by the Indigo-Carmine method. Flow was continued until effluent reached 0.1 ppm oxygen. The amount of oxygen removed did not vary with change in flow rate, pH or temperature. Some resin broke down during runs, particularly at the highest temperature, causing high pressure drops and low oxygen removals. Total solids in effluents ranged from 8 ppm at the start of a run to 111 ppm at the end. Analyses of effluent water showed a maximum of 1.2 ppm copper content. Regeneration of the resin columns was complex and caused leaching of copper oxides. Successive regenerations caused the resin to break down into fines which blocked flow through the column.

Institute of Engineering Research, U. of California, Berkeley.
THE ELASTIC-PLASTIC CYLINDER SUBJECTED TO RADIALLY DISTRIBUTED HEAT SOURCE, LATERAL PRESSURE AND AXIAL FORCE WITH APPLICATION TO NUCLEAR REACTOR FUEL ELEMENTS, by T. B. Kammash, S. A. Murch, and P. M. Naghdi. Technical rept. no. 1 on Contract DA 04-200-ORD-171, continuation of U. of Michigan Contract DA 20-018-ORD-14447. July 59, 40p. 14 refs. Series 130, issue 1; OOR rept. 2275.1-E; AD-226 197.
Order from LC mi$3.00, ph$6.30 PB 148 437

The elastic-plastic deformation of a solid cylinder in the presence of a distributed heat source and subjected to a lateral pressure p and an axial force F is considered in detail using Tresca's yield function, its associated flow law, and a linear work-hardening law Particular attention is given to the class of problems in which the radial stress, and not the axial stress, is the intermediate principal stress. The general results are applied to the cylindrical nuclear reactor fuel element in the state of plane strain with a radially distributed Gaussian heat source, acting in its fissionable interior. The solution is expressed in closed form in terms of the exponential integral and the incomplete gamma function and is found to exhibit 3 stages of plastic deformation. In stage I the plastic domain consists of 2 concentric and adjacent zones with different stress fields and different rates of propagation which expand outward from the center of the cylinder; in stage II the elastic domain vanishes, while the inner plastic zone continues to propagate; and in stage III a third plastic zone is formed at the outer radius which propagates inward. Throughout the deformation the states of stress are found to exhibit regular progression. A numerical example is included. (Author)

Nepa Div., Fairchild Engine and Airplane Corp., Oak Ridge, Tenn.
THE NEPA CRITICAL EXPERIMENT FACILITY: MATERIALS FOR ANP ZERO POWER REACTOR EXPERIMENTS, by F. T. Bly. 16 Apr 51, declassified 31 Aug 57, 47p. NEPA 1829, Appendix C of NEPA 1769.
Order from LC mi$3.30, ep$9.30 PB 149 472

Contents:
Geometry of zero power reactor blocks
Quantity of materials
Purity of materials
Density of materials
Cost of materials

Nuclear Reactions

Avco Research Lab., Everett, Mass.
LOW ENERGY ELASTIC SCATTERING ON ELECTRONS BY OXYGEN AND NITROGEN, by P. Hammerlind, W. W. Shine, and B. Kivel. Rept. on Contract AF 04(645)18. Mar 57, 19p. 9 refs. Research rept. 6 (formerly Research note 31) AD-150 621.
Order from LC mi$2.40, ph$3.30 PB 147 395

The elastic scattering of slow electrons by O and N is calculated by the method of phase shifts. The Hartree potential gives a cross section (2×10^{-15} cm^2) for O on the order of magnitude needed to agree with the experiments of Lamb and Lin in air. Since the Hartree potential is known to be too weak as it neglects exchange and polarization, this agreement is considered fortuitous. Exchange forces are introduced by a new approximation based on a suggestion of Slater for bound atomic states. The exchange approximation is adjusted to fit the more elaborate calculation of Bates and Massey for zero energy and zero polarization. The addition of a reasonable polarization force results in an acceptable potential and closer agreement with experiment. A similar calculation is made for nitrogen. In this case the Hartree potential alone gives a cross section which is too large. The inclusion of exchange and polarization leads to better agreement with the measurements in air. (Author)

Nuclear Development Corp. of America, White Plains, N. Y.
FAST NEUTRON CROSS SECTIONS OF IRON, SILICON, ALUMINUM AND OXYGEN, by E. S. Troubetzkoy. Final rept. for 17 Dec 58-30 Sep 59 on Contract DA 18-108-405-cml-295. 1 Nov 59, 58p. 54 refs. NDA 2111-3, Vol. C; AD-233 939.
Order from LC mi$3.60, ph$9.30 PB 146 779

A set of neutron cross sections for iron, silicon, aluminum, and oxygen has been prepared for energies up to 18 Mev. The cross sections tabulated include

σ_T, σ_{nn}, σ_{nn} , σ_{nx}, $\sigma_{n\gamma}$, $\sigma_n(\theta)$, $\sigma_{nn'}(E, E')$, $\sigma_{nn'\gamma}(E, E_\gamma)$, σ_{n2n}, and cross sections for charged particle emission. (Author)

Pennsylvania U., Philadelphia.
TOTAL GAMMA ABSORPTION IN C^{12}, N^{14}, O^{16}, AND Al^{27} AT 20 MEV, by Edward E. Carroll, Jr. Technical rept. no. 5 [6] on Contract Nonr-551(17). Sep 59, 130p. 107 refs. AD-235 189.
Order from LC mi$6.30, ph$19.80 PB 148 591

Total gamma absorption cross-sections of C^{12} from 20.0 to 21.15 Mev, and of N^{14}, O^{16}, and Al^{27} from 20.0 to 20.5 Mev, were measured using monochromatic gamma rays. A direct absorption technique was used in which samples were placed between the target of an electrostatic generator, and large sodium-iodide scintillation detectors. Monochromatic photons from the T^3 (p,γ)He^4 reaction were varied in energy by changing the energy of the incident protons. The C^{12} cross-section showed pronounced structure with resonances resolved at 20.15 Mev, 20.46 Mev, and 20.92 Mev, with integrated cross-sections of 1.1, 1.0, and 6.6 Mev-millibarns respectively. Oxygen showed a sharply rising cross-section suggesting a strong resonance peaked above about 20.5 Mev. The cross-sections of N^{14} and Al^{27} were smooth over the energy interval investigated. (Author)

Vienna U. (Austria).
ON THE RENORMALIZATION OF BETA COUPLING, by K. Baumann and A. Höld. Scientific note no. 1 on Contract AF 61(052)265. 17 Nov 59, 5p. 5 refs. AFOSR-TN-60-26; AD-232 391.
Order from LC mi$1.80, ph$1.80 PB 146 712

The renormalization of the vector and axial vector current is calculated for a single Dirac field which is coupled to itself. A nonlocal Fermi-type interaction is introduced which has been treated by Abrikosov et al (Phys. Rev. 111:321, 1958). In the limit of small nonlocality the renormalization can be performed nonperturbationally. The vector nonrenormalization and an axial vector renormalization factor are found to be greater than one. (Author)

Radioactivity

Cuyo U., Mendoza (Argentina).
THE OSCILLOSCOPE METHOD OF MEASURING NUCLEAR HALF-LIVES, by I. Bergström, E. Bonacalza and others. Technical note no. 2 on Contract AF 61(052)118. 1 Feb 60, 39p. 23 refs. AFOSR-TN-60-295; AD-234 429.
Order from LC mi$3.00, ph$6.30 PB 146 643

It is shown that the modern fast oscilloscopes now available commercially are very simple and powerful tools for measuring nuclear half-lives. The advantages and the limitations of the method are discussed. In order to illustrate the problems which are associated with measurements in different half-life regions, seven half-lives associated with metastable states in nuclei were measured. The oscilloscope method can be used in the whole region where conventional delayed coincidence technique is applicable. A very great advantage of the oscilloscope method is that above about 1 μs, it can be very easily used as a multi-channel time analyzer, by continuously photographing the events on the oscilloscope screen.

Naval Radiological Defense Lab., San Francisco, Calif.
ACTIVITY-SIZE RELATIONSHIP OF FALLOUT PARTICLES FROM TWO SHOTS, OPERATION REDWING, by H. K. Chan. 19 Feb 59, 71p. 10 refs. Research and Development Technical rept. USNRDL-TR-314; AD-233 607.
Order from LC mi$4.50, ph$12.30 PB 146 474

The activity of coral fallout particles was studied as a function of individual size. Single particles from 2 shots at Operation Redwing were sized and identified as being of a spheroidal, irregular or dendrite-like type and then measured for gamma activity. Two particle size parameters were employed, equivalent projected area diameter (D_a) and maximum diameter (D_m). The study shows that an extensive range of activities is associated with each size and size-type group. Field data taken at one station indicate that the activities of a size-type group follow a normal distribution. According to the same data the activity varies as $D_a^{2.2}$ and $D_m^{1.7}$ for irregular particles, $D_a^{3.7}$ for spheriodal particles, and $D_m^{2.1}$ for dendrite-like particles. (Author)

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Arctic Aeromedical Lab., Ladd AFB, Alaska.
AN EVALUATION OF SOME SURVIVAL GILL NETS, by T. Saunders English. Mar 57, 14p. 3 refs. Technical note AAL-TN-57-3.
Order from LC mi$2.40, ph$3.30 PB 146 621

This study was to examine the survival gill nets supplied to compare the types of nets available and to find a quantitative expression of the amount of food to be expected from fishing with a survival net in at least a few situations. The desirable knowledge seems to include information on whether to use the net and, successively, where, how, and for what duration. The appendix is offered in an attempt to supply such in information.

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE EXCHANGE OF RADIANT ENERGY BETWEEN CLOTHED MEN AND A DESERT ENVIRONMENT, by A. A. Woodward, W. V. Blevins, and C. M. Greenland. Feb 60, 47p. 22 refs. CWLR-2354.
Order from LC mi$3.30, ph$7.80 PB 148 029

Direct measurements were made of the intensity of direct solar radiation and of sources of diffuse radiation in a desert environment. These showed complex diurnal variation, but followed a regular pattern from day to day. The contributions of each source

to the thermal load on clothed men was also measured. Despite large differences in intensity between solar radiation and diffuse radiation, the actual amount of heat absorbed by clothed men from each of these sources is about the same. (Author)

Material Lab., New York Naval Shipyard, Brooklyn
INVESTIGATION OF CURRENT COMMERCIAL DEVELOPMENTS IN SUNGLASSES WITH POSSIBLE APPLICATIONS FOR MILITARY USE, by L. Banet. Final rept. 30 Dec 58, 31p. 6 refs. Lab. Project 5898-2; AD-225 236L.
Order from LC mi$3.00, ph$6.30 PB 147 241

Data on lens and frame materials were received from twelve manufacturers, including visible light transmission characteristics, optical tolerances, and current prices. The only improvement noted in the survey was the improved abrasion resistance of polarized lenses, which was corroborated by laboratory experiments; no significant improvement in plastic frame materials was observed. In the absence of a satisfactory substitute for the military sunglass specified in Jan-G-475, criteria were developed for desired improvements in design and materials of military sunglasses.

Material Lab., New York Naval Shipyard, Brooklyn, N. Y.
A LENS SYSTEM FOR THE MILITARY GENERAL PURPOSE GOGGLES, by L. Banet and M. Kleinman. Final rept. 24 Sep 59, 30p. 11 refs. Lab. Proj. 6159; AD-235 272.
Order from LC mi$2.70, ph$4.80 PB 147 251

The development of a double lens system was initiated to meet the objections which arise from fogging. The literature was reviewed for the purpose of eliciting useful methods for reducing fogging; anti-fog coatings, anti-dim discs, double-layer lenses, various types of air circulators and electrically heated coatings were employed with varying degrees of success. As a satisfactory solution to the fogging problem, a rubber gasket adapter was designed which fits over the standard frame and which secures a second, spare lens of the kit above the standard lens. Two additional modifications of the double-lens are suggested to improve the effectiveness of the system: The first is a thermo-double lens utilizing metallic coatings, and the second involves use of anti-dim inserts of an Ansco material. Prototypes of coated lenses and anti-dim inserts were fabricated. (Author)

PHYSICS

Texas U., Austin.
EFFECTS OF PRESSURE ON PROTON SPIN-LATTICE RELAXATION IN SEVERAL ORGANIC LIQUIDS, by A. W. Nolle and P. P. Mahendroo. Technical rept. no. 10 on Contract Nonr-375(05). 6 Aug 59, 16p. 13 refs. AD-225 928.
Order from LC mi$2.40, ph$3.30 PB 148 142

The proton longitudinal nuclear magnetic resonance relaxation time (T_1) is measured at 29 mc for pressures up to 1400 kg/cm^2 in degassed samples of toluene, benzene, cyclohexane, methyl iodide, 1, 1, 1-trichloroethane, n-heptane, and chloroform. The results are compared with data of Benedek and Purcell [J. Chem. Phys. 22:2003, 1954], who found for several liquids that T_1 decreases with pressure much less rapidly than the reciprocal of the viscosity. For globular and linear molecules (e. g., methyl iodide, n-heptane), the earlier conclusions are not affected by use of degassed samples. For the aromatic molecules, however, T_1 in degassed samples varies roughly with the reciprocal viscosity or the self-diffusion coefficient, contrary to the result obtained without degassing. This is taken to mean that rotational and translational jump rates are reduced by comparable amounts upon application of pressure to these liquids. (Author)

Acoustics

Armed Forces-NRC Committee on Hearing and Bio-Acoustics, St. Louis, Mo.
CHABA ANNUAL REPORT NO. 6, by Hallowell Davis, Donald H. Eldredge, and Shirley K. Hirsh. Technical rept. no. 16, 1 June 58-31 May 59, on Contract Nonr-1151(01). June 59, 46p. 24 refs. AD-219 759.
Order from LC mi$3.30, ph$7.80 PB 146 692

See also PB 142 548

David Taylor Model Basin, Washington, D. C.
THE NEAR-SOUND FIELD OF TURBULENCE, by G. J. Franz. Oct 59, 38p. 24 refs. Rept. 982.
Order from LC mi$3.00, ph$6.30 PB 148 855

General expressions for the velocity potential, particle velocity, instantaneous sound pressure, mean-square sound pressure, and sound intensity for the sound generated by turbulence are derived, starting from Lighthill's fundamental relations for the density fluctuations in the medium outside a turbulent region. The dipole radiation from the turbulent boundary layer of a rigid boundary, the quadrupole radiation from isotropic turbulence, and the lateral quadrupole radiation from turbulence in the presence of a large mean shear are discussed. The frequency spectra and directional patterns of the sound observed at points in the sound field that are much less than a wavelength from multipole sound sources are shown to differ significantly from the frequency spectra and directional patterns of the sound observed at points in the sound field that are many wavelengths from the multipole sound sources. (Author)

General Applied Science Labs., Inc., Westbury, N. Y.
THE OSCILLATION AND NOISE OF AN OVER-PRESSURE SONIC JET, by Andrew G. Hammitt. Rept. on Contract AF 49(638)194. Nov 59, 40p. 4 refs. GASL Technical rept. no. 137; AFOSR-TN-59-1307; AD-233 878.
Order from LC mi$3.00, ph$6.30 PB 146 364

A series of experiments on plane 2-dimensional and axially symmetric over pressure sonic jets was per-

formed to study the oscillating behavior of the jet and accompanying sound field. Shadowgraphs were obtained which show the oscillations and generation of the sound waves for the plane 2-dimensional jet in some detail; but similar results could not be obtained for the axially symmetric jet. Measurements from these pictures show that the oscillating jet and sound fields can be described in terms of the length of the shock wave cells. The importance of the sound waves acting upon the base of the jet is demonstrated, and it is found that the jet can be stabilized by shielding its base from these sound waves. (Author)

Michigan U. Research Inst., Ann Arbor.
APPLICATIONS OF SIGNAL DETECTABILITY THEORY TO PSYCHOPHYSICAL RESEARCH: A BIBLIOGRAPHY, by C. D. Creelman. Technical momo. no. 79 on Contract AF 19(604)2277. June 60, 15p. 149 refs. 2659-10-T; AFCCDD-TN-60-14.
Order from LC mi$2. 40, ph$3. 30 PB 148 802

Michigan U. Research Inst., Ann Arbor.
DETECTION OF SIGNALS OF UNCERTAIN FREQUENCY, by C. D. Creelman. Technical memo. no. 71 on Contract AF 19(604)2277. Sep 59, 25p. 10 refs. 2659-5-T; AFCRC-TN-59-60.
Order from LC mi$2. 70, ph$4. 80 PB 148 800

Alternative models for extension of frequency sensitivity in human observers are discussed. One decision procedure for a multiple filter model is considered in some detail as a general model for decision situations in which each available response specifies a subset of the signal alternatives. Two experiments were conducted in an attempt to choose between a sweeping-filter model and a multiple-filter model. Detection in a two-alternative forced-choice experiment in which the signal could be one of two possible signals was measured as a test of the two models. The data, in connection with other available studies, are taken to show the need for a more complex model for auditory discrimination. (Author)

Michigan U. Research Inst., Ann Arbor.
THE THEORY OF SIGNAL DETECTABILITY AS IN INTERPRETIVE TOOL FOR PSYCHOPHYSICAL DATA, by W. P. Tanner, Jr. Technical momo. no. 78 on Contract AF 19(604)2277. May 60, 33p. 12 refs. 2659-9-T; AFCCDD-TN-60-13.
Order from LC mi$3. 00, ph$6. 30 PB 148 801

The theory of signal detectability is examined from the standpoint of determining a set of satisfactory assumptions for the purpose of developing an interpretive tool for use in psychophysical experiments. It is concluded that the assumption that the observer attempts to maximize the expected value of the outcome of the experiment is satisfactory for this purpose, and that a set of physical conditions can be established which justify a computation of the detectability of a signal in noise based on a finite sampling plan involving 2WT amplitude values over the open interval, O to T. (Author)

Middle Tennessee State Coll., Murfreesboro.
SOUND ABSORPTION IN THE HALOGEN GASES, by F. D. Shields. Final rept. on Relaxation Process in Gases, Contract Nonr-2347(00). [1959] 20p. 16 refs. AD-225 391.
Order from LC mi$2. 40, ph$3. 30 PB 148 576

Apparatus has been constructed for measuring sound absorption by the tube method in corrosive gases at high temperatures. This apparatus has been used to measure sound absorption in chlorine, bromine and iodine vapors at temperatures between 25 and 256°C. The measurements revealed vibrational relaxation absorption peaks in all the gases. In Cl_2 the relaxation times varied from 4. 90 μsec at 25°C to 1. 55 μsec at 255°C. In Br_2 the variation was from 0. 854 μsec at 28°C to 0. 460 μsec 256°C. In I_2 the relaxation time was almost independent of temperature, changing only from 0. 106 to 1. 102 μsec when the temperature changed from 112 to 253°C. The heights of the absorption peaks were adequately predicted by assuming the relaxing vibrational specific heat to be C_p - 7/2 R. Neither the Schwartz-Herzfeld nor Cottrell-Ream theoretical equations for the relaxation time accurately predict the measured variation with temperature, molecular mass and vibrational frequency. (Author)

Naval Ordnance Test Station, China Lake, Calif.
BIOLOGICAL ENVIRONMENT AS RELATED TO THE TRANSMISSION OF SOUND IN THE SEA. THE DEEP SCATTERING LAYER, by Giorgio Soli. 28 July 59, 18p. 37 refs. NOTS TP 2309; NAVORD rept. 6581; AD-226 614.
Order from LC mi$2. 40, ph$3. 30 PB 148 447

The deep scattering layer is formed by a concentration of marine animals living at a depth of 300-800 meters. It can be found in every part of the world and has the characteristic of performing a diurnal vertical migration of several hundred meters. Only planktonic animals and certain fishes may show a vertical migration of the type pecular to the deep scattering layer. The organisms that constitute the layer have not been clearly identified.

Psycho-Acoustic Lab., Harvard U., Cambridge, Mass.
PERIODIC STATUS REPORT XXXIII. Rept. for 16 Nov 58-15 May 59 on Contract Nonr-1866(15). 15 May 59, 21p. 77 refs. PNM-82.
Order from LC mi$2. 70, ph$4. 80 PB 146 685

The list of reports published here starts with PNR-151 (Psycho-Acoustic Navy Report) and contains references to all research published since mid-1954. Copies of the full list (PNR-1 to the present) are available on request. The designation "PAL" in this list indicates that the report was reproduced and distributed directly by the Psycho-Acoustic Laboratory. When no date of publication is given, it indicates that the article has not yet appeared in print. (See also PB 144 685)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
ANTENNA PROBLEMS OF MEASUREMENT OF THE AIR-EARTH CURRENT, by Heinz W. Kasemir and Lothar H. Ruhnke. 15 Apr 59, 16p. 3 refs. USASRDL Technical rept. 2022; AD-228 435.
Order from LC mi$2.40, ph$3.30 PB 146 342

The antenna used to collect the air-earth current often distorts the lines of current flow in the air. It also introduces other voltage sources such as the volta potential from the wire or metal plate or piezoelectric charges from cables and insulators. These voltage sources may make the measurement of the air-earth current faulty. This report shows under what conditions a true current measurement is achieved and how the influence of the volta potential and piezoelectric effect can be avoided. A method is described whereby the model factor of even complicated antenna forms can be determined by a simple capacity measurement. (Author)

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
DEVELOPMENT OF MAGNETOSTRICTIVE AND RELATED MATERIALS, Final progress rept., Part 2, 10 Apr 52-9 Apr 54, on Contract AF 18(600)302. [1954] 60p. 25 refs. Rept. no. F-2306, Part 2; AFOSR-TR-54-24.
Order from LC mi$ .60, ph$9.30 PB 146 528

A study of the effects of the order-disorder transformation was made on alloys with compositions near Ni_3Mn, Fe_3Pt, and $FePd_3$. In the Fe-Pd alloys, the work was extended to include measurement of saturation moment at low temperatures and of the long-range order parameter. The kinetics of the ordering process in Fe_3Pt alloys were studied at temperatures from 450 to 750°C. Resistivity measurements on polycrystalline wires were used to follow the ordering process.

Geophysical Inst., U. of Alaska, College.
THE EFFECT OF TOPOGRAPHY AND GEOLOGY ON TELLURIC CURRENTS, by E. M. Westcott and V. P. Hessler. Scientific rept. no. 3 on Contract AF 19(604)3075. Apr 60, 64p. 25 refs. AFCRC-TN-60-431.
Order from LC mi$3.90, ph$10.80 PB 148 017

The electric field vectors E, associated with telluric currents are known to vary in comparative magnitude and principal direction at different locations. Large differences in the vectors from several Alaskan stations prompted a study to determine what effect topography and geology have on the telluric field. The results of this study show that the comparative magnitude may change by a factor of five and the principal direction may range over 33 degrees, and in one extreme case 70 degrees in the area. Model studies using a resistor network were made to determine the effects of some simple topographic and conductivity configurations upon the telluric field. Some of the interesting field results are explained on the basis of the model studies and the resistivity measurements.

Institute of Research, Lehigh U., Bethlehem, Pa.
IMPROVED MAGNETIC MATERIALS, by Ernest Costello, Arnold Holtzman, and Harry Suprinick. Quarterly progress rept. no. 2, 16 Oct 56-15 Jan 57, on Contract DA 36-039-sc-70120. [1957] 27p. 12 refs. AD-138 072.
Order from LC mi$2.70, ph$4.80 PB 149 365

A resume of the theoretical bases for the work on manganese alloys is presented. Additional alloys for the Mn_4C phase of the work have been prepared and are now being homogenized. Further alloy preparation in the Mn_3AlC phase of the work has included a nominal Mn_3CoC alloy which displayed weak ferromagnetism and a nominal Mn_3AlC alloy showing strong ferromagnetism. The X-ray analysis of the magnetic particles extracted from the Mn_3NiC alloy reported on the last report has not been completed. Specimens of a nominal 8% Si-Fe-Si alloy have been prepared for determination of the ordering temperature. Progress has also been made in spark machining rings of the same alloy for magnetic analysis and satisfactory metallographic techniques appear to have been arrived at for the microscopic study of these alloys. Further work on slag melting of alloys is underway. Following reconstruction of the magnetostriction equipment under the supplement to the preceding contract work has been progressing on adaptation of this equipment to high temperature magnetostriction measurements. (Author)

Naval Ordnance Test Station, China Lake, Calif.
INFLUENCE OF LIGHT ON FERROMAGNETISM, by Julian L. Thompson. 6 Jan 58, 26p. 7 refs. NOTS 1935; NAVORD rept. 5840; AD-162 984.
Order from LC mi$2.70, ph$4.80 PB 148 370

Nearly unmagnetized samples of certain iron-nickel alloys are rendered slightly more or less magnetic by the action of light falling on the surface, depending upon the magnetic history of the sample. The effect disappears as soon as the light is removed, the changes taking place in a few milliseconds. Under the same conditions, a certain iron-silicon alloy shows an effect which remains after the illumination is removed. Mechanical shock will produce the same effect as light. The response to light is roughly proportional to intensity and seems to be largely due to the red and near infrared portions of the spectrum. (Author)

Western Ontario U. (Canada).
FINAL REPT. FOR 1 SEPTEMBER 1958-30 AUGUST 1959, ON CONTRACT NONR-2665(00), by R. Stevenson. 30 Aug 59, 35p. 28 refs. AD-226 027.
Order from LC mi$3.00, ph$6.30 PB 148 191

Magneto-optical rotation by transmission through or reflection from solids is examined by the classical free electron theory, with the view of taking such a measurement using fields in the megagauss range. In general the rotation is a markedly non-linear function of the magnetic field, and in some cases can change in sign as the field increases. For very low fields the rotation varies directly with B, but in the high field limit the rotation varies inversely with the field. For substances in which the intercollision time of the electron is small, measurments of the Kerr rotation

(i.e., by reflection) will give the electron mobility as a function of the magnetic field, and thus will give important data which can be used in conjunction with high-field magneto-resistance experiments. (Author)

Electronics

Air Force Cambridge Research Center, Bedford, Mass.
ELECTRONIC MATERIAL SCIENCES LABORATORY, by E. W. Sampson and O. N. L. Denniston. Status rept. 1 Dec 59, 203p. 43 refs. AFCRC-TR-59-360; AD-233 841.
Order from LC mi$9.30, ph$31.80 PB 146 349

Airborne Instruments Lab., Inc., Mineola, N. Y.
INTERFERENCE BLANKER MX-2024(XW-1)/UPA, by Harold Kurland. Final engineering rept. on Contract AF 30(602)1454. Feb 58, 16p. 4 refs. Rept. no. 3581-1; RADC TR-58-56; AD-148 688.
Order from LC mi$2.40, ph$3.30 PB 146 373

A pulse-interference separator and blanker for the reduction of random pulse interference in Normal and MTI video has been investigated, developed, and constructed. A means of reducing the loss of information that normally results when operating with MTI video is incorporated in this equipment. (Author)

Airborne Instruments Lab., Mineola, N. Y.
NONLINEAR ANTENNA STUDY, by C. O. Ball. Technical note on Contract AF 30(602)1873. Dec 58, 28p. Rept. no. 5341-TN-1; RADC-TN-58-305; AD-148 975.
Order from LC mi$2.70, ph$4.80 PB 146 594

This technical note presents the results of the first stage of investigation pursuant to a study concerned with nonlinear antenna systems. The purpose of this first stage was to evaluate the A-J characteristics of self-adjusting antennas. A self-adjusting antenna is a system of antennas with a combining method that involves automatically rephasing the inputs so that the jammer components are canceled upon additive combination. Effectively, this is a system for automatically placing a null of a linear array on a jammer location. A short evaluation was also made of a related antenna utilizing an analytic solution of an equation involving the jammer-plus-signal phasor.

David Sarnoff Research Center, Princeton, N. J.
THERMIONIC EMISSION STUDIES, by G. A. Morton, A. H. Sommer and others. Quarterly rept. no. 3, 1 Apr-30 June 59, on Contract DA 36-039-sc-78155. [1959] 49p. 17 refs.
Order from LC mi$3.30, ph$7.80 PB 147 272

Thermionic Emission: Work on the tungsten bronzes has been discontinued as showing insufficient promise. The reasons for this decision are discussed. Hot Electron Emission (HEE) from Silicon: The study of Cs-treated silicon junctions was continued, in particular the effect of the Cs on the rectification properties of the junction and the change of HEE with time. The relationship of HEE threshold voltage to breakdown voltage was investigated, leading to a preliminary interpretation deviating from earlier assumptions. Measurements were also made to distinguish the resistance of the junction from the resistance of the silicon in series with it. (Author) (See also PB 145 236)

Electronics Research Lab., U. of California, Berkeley.
RECIPROCITY THEOREMS FOR ELECTROMAGNETIC FIELDS WHOSE TIME DEPENDENCE IS ARBITRARY, by W. J. Welch. Rept. on Contract N7onr-295(29). 11 June 59, 15p. 4 refs. Rept. no. 88; Series no. 60, issue no. 237; AD-227 407.
Order from LC mi$2.40, ph$3.30 PB 146 583

Two reciprocity theorems are derived which are valid for fields whose sources may have arbitrary time dependence. The first theorem involves the electromagnetic potentials, and the second is in terms of the electric and magnetic fields directly. In both cases it is necessary to make use of the advanced as well as the retarded solutions to Maxwell's equations. Some properties of the theorems are discussed, and as an application, the second is used to derive a variational expression for scattering of electromagnetic waves from a perfect conductor. (Author)

Michigan U. [Research Inst.] Ann Arbor.
SOME GENERAL PROPERTIES OF THE HEARING MECHANISM, by W. P. Tanner, Jr., J. A. Swets and others. Technical rept. no. 30 on Contract DA 36-039-sc-63203. Mar 56, 100p. 41 refs. 2262-108-T.
Order from LC mi$5.40, ph$15.30 PB 149 363

This report deals with the auditory processes of detection and frequency analysis. It presents a decision-making theory of detection and some data supporting the theory. Other data included are consistent with a theory of frequency analysis that characterizes the human observer as instantaneously sensitive to a limited range of frequencies, with a shifting of the frequency range of sensitivity requiring a measurable amount of time. Finally, the problem of speech perception is considered in terms of the mechanism inferred from these studies. The results of this investigation are regarded as contributing to the methodology of psychophysical testing, to auditory theory, and to general behavior theory. The data indicate directly a need for certain innovations in conventional testing procedures by virtue of exhibiting some properties of the auditory mechanism not previously considered. The nature of both the detection and frequency-analysis properties discussed calls for a recognition of the influence of central processes on sensory processes, and demonstrates the feasibility of studying central processes by sensory experiments. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
ON THE THEORY OF M-TYPE TUBES WITH THICK BEAMS, by Georges Mourier. Rept. on Contract AF 49(638)340. 22 Aug 58, 20p. 12 refs. Research rept. R-680-58; PIB-608; AFOSR-TN-58-926. AD-204 738.
Order from LC mi$2.40, ph$3.30 PB 147 446

The effects of space charge in crossed field, M-type tubes is considered qualitatively. The consideration of 2 surface waves associated respectively with the upper and low boundaries of the beam make possible a broad understanding of the behavior of M-type tubes with thick, heavy-current beams. No systematic comparison of theory with experiments is made. However, the gain calculation seems to be in general agreement with experiment, as is the prediction of a minimum efficiency for intermediate values of beam current. The most serious restriction on this analysis is probably the assumption of laminar flow. (Author)

Naval Research Lab., Washington, D. C.
SOURCE AND DETECTOR CORRECTIONS FOR ANGULAR CORRELATION MEASUREMENTS, by F. C. Young. Interim rept. 20 June 60, 9p. 4 refs. NRL rept. 5475.
Order from LC mi$1.80, ph$1.80 PB 145 718

The geometrical corrections to the angular correlation function for circular detectors with spherical and cylindrical sources have been calculated. The calculations were made to second order in terms of the various geometrical parameters, and curves were plotted showing the dependence of the corrections on these parameters, as well as on the correlation angle. The parameters were: the angle between the two gamma rays; the angle between the symmetry axes of the two detectors of solid angle $d\Omega_1$, and $d\Omega_2$; the radius of the detectors; the radius of the source; and the distance from the source to the center face of each detector. An extension of these corrections to include cylindrical detectors was investigated and the results were of the same mathematical form as for circular detectors. (Author)

Navy Electronics Lab., San Diego, Calif.
SEQUENTIAL SIGNAL DETECTOR, RAYLEIGH CASE, by J. W. Caspers. 7 Nov 56, 33p. 5 refs. Research rept. 730.
Order from LC mi$3.00, ph$6.30 PB 149 187

A detector based on the sequential probability ratio test has been examined theoretically. It is shown that it will respond to signals more rapidly, on the average, than the best non-sequential detector. Equations and curves are given which predict the performance of the sequential detector and compare it with that of the Neyman-Pearson detector. Further analyses and experimentation are outlined which are directed toward a more comprehensive understanding of the sequential detector, toward its simplification, and toward an estimation of its value as a signal-to-noise ratio estimator. (Author)

Washington U. [Seattle]. Coll. of Engineering.
ANTENNA PATTERNS FOR MAXIMUM INFORMATION RATE, by Paul A. Lux, H. Myron Swarm, and David D. McNelis. Technical rept. no. 41 on Contract AF 19(604)4098. Apr 60, 33p. 6 refs. AFCRC-TN-60-175.
Order from LC mi$3.00, ph$6.30 PB 148 236

This paper is concerned with finding the optimum directivity pattern of an antenna. Because of irregularities in the atmosphere, ionosphere, or meteor bursts a signal does not arrive at the receiver from a single direction. Therefore maximum directivity with its attendant narrow beam width may not be the best criterion of antenna performance. Nor is the performance of an omnidirectional antenna apt to be optimum regardless of how optimum is defined. However, a directivity pattern between these two extremes results in optimum performance when a logical definition of optimum is applied. The optimum directivity pattern is determined by the type of signal to be received and the type of receiver being used. In this paper, an optimum pattern is defined and determined as a function of the distribution of the incoming signal power in azimuthal angle. Systems similar to meteor-burst channels are considered, i.e., the signals are assumed to arrive in discrete, non-overlapping bursts. (Author)

Molecular Physics and Spectroscopy

Carnegie Inst. of Tech., Pittsburgh, Pa.
AUTOMATIC COMPUTATION OF ELECTRONIC ENERGIES OF DIATOMIC MOLECULES, by Tadashi Arai. Technical rept. on Contract DA 36-061-ORD-466. [1960] 69p. 10 refs. OOR rept-1350.16-C; AD-233 992.
Order from LC mi$3.90, ph$10.80 PB 148 533

A general method for computing electronic energies and wave functions of diatomic molecules is described and arranged in such a way that the processes of the computation are carried through systematically and fully automatically by an electronic computer. In principle, therefore, we are able to compute the energy values and the wave functions by inserting the number of electrons in the molecule concerned, the spin multiplicity S, the angular momentum (its component L along the nuclear axis) and other symmetry requirements, if we decide what kind of basic functions we wish to use as orbitals. At the first step, an orthonormal set of orbitals is built up from the orbitals assumed as bases. By taking every possible combination of the orthonormal orbitals, candidate basic functions are generated. Each of them is tested to see if it satisfies the symmetry requirements of the molecule. Thus all the basic functions which should be obtained from the orbitals assumed are systematically generated. The energy matrix involving them is calculated by the use of the representation matrices of the permutation group. Every necessary permutation for computing the energy matrix is considered automatically by the computer. The only data required to be stored in the machine are spin functions and the representation matrices of the permutation group for a small number of electrons (say 6 electrons). Those are universal quantities for any kind of Fermi particles and are easily obtainable. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
SENSITIVITY OF MICROWAVE SPECTROMETERS AND HYPERFINE SPECTRA OF $CFCl_3$, by Maurice W. Long. Doctoral thesis. Technical rept. no. 1 on Contract Nonr-991(07). 15 June 59, 110p. 41 refs.
Order from LC mi$5.70, ph$16.80 PB 147 451

Comparisons based on theoretical and experimental investigations are made on the following detection system for use with Stark spectrographs: crystal diodes and tuned amplifiers, bolometers and tuned amplifiers, and superheterodynes in conjunction with a microwave bridge. Equipment modifications are described which provide improved sensitivity for detecting small decrements in a relatively large amount of power; the modified equipment is sensitive to signal changes of one part in 10^{10}. Absorption lines at X-band having a calculated absorption coefficient at room temperature of 4×10^{-11} cm^{-1} were measured. It is believed that these are the weakest lines ever reported. A theoretical calculation is made for the hyperfine structure of the $J = 1 \rightarrow 2$ rotational transition for symmetric top molecules having three identical nuclei of spin 3/2. This calculation is used to analyze the $CFCl_3^{35}$ transition at 9.86 kmc, and provides the quadrupole coupling constant with respect to the molecular symmetry axis.

Hebrew U. (Israel).
ELECTRON PARAMAGNETIC RESONANCE IN $BaTiO_3$, by W. Low and D. Shaltiel (Israel Inst. of Tech.) Rept. on Contract AF 61(052)59. [1959] 3p. 3 refs. AFOSR-TN-58-919; AD-234 036.
Order from LC mi$1.80, ph$1.80 PB 149 290

Institute of Mathematical Sciences, New York U., N. Y.
THE APPLICATION OF WAVE FUNCTIONS CONTAINING INTERELECTRON COORDINATES II. THE GROUND STATE ENERGY OF ATOMS, by Peter Walsh and Sidney Borowitz. Rept. on Contracts AF 19(604)4555 and DA 30-069-ORD-2581. Dec 59, 42p. 23 refs. Research rept. no. CX-45; AFCRC-TN-59-657; AD-233 304.
Order from LC mi$3.30, ph$7.80 PB 146 568

An attempt was made to explore further the use of interelectron coordinates in constructing atomic wave functions. A simple method is developed for constructing wave functions of this type which yields surprisingly good values for the energy of a variety of atomic systems in zero order. (See also PB 142 836)

Little, Arthur D., Inc., Cambridge, Mass.
INFRARED SPECTRA OF GASEOUS GROUP IV HALIDES: ZIRCONIUM FLUORIDE, ZIRCONIUM CHLORIDE AND HAFNIUM CHLORIDE, by Alfred Büchler. Interim technical rept. no. 1 on Study of High-Temperature Thermodynamics of Light-Metal Compounds, Contract DA 19-020-ORD-4829. 20 Apr 60, 10p. 10 refs. OOR rept. 006.1-C.
Order from LC mi$1.80, ph$1.80 PB 148 429

The infrared spectra of gaseous ZrF_4, $ZrCl_4$, and $HfCl_4$ have been observed between 3000 and 200 cm^{-1}. The observed frequencies are

	ν_3 cm^{-1}	ν_4 cm^{-1}
ZrF_4	668	200
$ZrCl_4$	423	---
$HfCl_4$	393	---

Lyman Lab. [of Physics] Harvard U., Cambridge, Mass.
N^{14} - N^{15} HYPERFINE ANOMALY, by L. Wilmer Anderson and Francis M. Pipkin. (Mallinckrodt [Chemical] Lab.). Rept. on Contract Nonr-1866, T.O. 14. [1959] 52p. 33 refs. AD-220 657.
Order from LC mi$3.60, ph$9.30 PB 148 151

The optical transmission of an optically oriented sodium vapor in spin exchange equilibrium with atomic nitrogen was used to measure the zero field hyperfine splitting of N^{14} and N^{15}. The nuclear moments of N^{14} and N^{15} were remeasured by observing the effects of saturating the nitrogen resonance on the proton resonance in NH_4^+. The N^{14} - N^{15} hyperfine anomaly obtained by combining measurements is

$\Delta = \frac{A(15)/A(14)}{g(15)/g(14)} - 1 = 0.000981 \pm 0.000017$. A short discussion of the mechanism of spin exchange collisions is given.

Malinckrodt Chemical Lab., Harvard U., Cambridge Mass.
MICROWAVE SPECTRUM, STRUCTURE, DIPOLE MOMENT AND NUCLEAR QUADRUPOLE EFFECTS IN VINYL CHLORIDE, by Daniel Kivelson, E. Bright Wilson, Jr., and David R. Lide, Jr. (National Bureau of Standards). Rept. on Contract Nonr-1866, T.O. 14. [1959] 19p. 16 refs. AD-220 658.
Order from LC mi$2.40, ph$3.30 PB 148 152

The microwave spectra of nine isotopic species of vinyl chloride have been measured and analysed, yielding moments of inertia from which a molecular structure was calculated. The bond lengths found are (in A) C=C 1.33_2, C-Cl 1.72_6, average C-H 1.08. The bond angles are C_2C_1Cl 122°, $C_2C_1H_1$ 124°, $C_1C_2H_3$ (cis to Cl) 121°, $C_1C_2H_2$ (trans to Cl) 120°. Planarity was assumed. The chlorine nuclear quadrupole hyperfine lines were re-examined. From the data for several isotopic species it was shown that the C-Cl bond direction is within five degrees of a principal axis of the field gradient tensor. The lack of cylindrical symmetry of the field gradient about the C-Cl bond was confirmed. This is evidence that the observed shortening of the C-Cl bond is at least in part due to conjugation with the C=C double bond and not solely to hybridization effects. The component of dipole moment along the a inertial axis was found to be 1.42 ± 0.02 D. (Author)

National Bureau of Standards, Washington, D. C.
STANDARDIZATION OF THERMAL EMITTANCE MEASUREMENTS, by William N. Harrison, Joseph C. Richmond and others. Rept. for 1 July 58-30 June 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)58-20. Mar 60, 37p. 3 refs. WADC Technical rept. 59-510.
Order from OTS $1.00 PB 161 879

The principles governing emission, transmission, reflection and absorption of radiant energy are briefly reviewed; definitions of pertinent terms as used in the text are given; and mathematical relationships between properties and quantities that are involved in the project are presented. A double-beam ratio-recording

spectrometer was modified so that it would compare radiant energy beams emitted by a blackbody furnace and a specimen at the same temperature, and record automatically a curve of normal spectral emittance of the specimen as a function of wavelength. Preliminary designs of equipment were formulated for the automati recording of spectral emittance data in a form suitable for direct entry into a computer, and for the on-line, automatic processing of data to obtain a single value for total emittance or for absorptance for radiant energy of any known spectral distribution. (Author)

Noyes Chemical Lab., U. of Illinois, Urbana.
THE INTENSITY OF THE INFRARED C≡N BAND OF p-ALKYLBENZONITRILES IN VARIOUS SOLVENTS, by Theordore L. Brown. Technical rept. no. 2 on Contract Nonr-2533(00). 10 Aug 59, 9p. 7 refs. AD-225 134.
Order from LC mi$1.80, ph$1.80 PB 148 127

The integrated intensities of the C≡N absorption in p-methyl, p-ethyl, p-isopropyl, and p-tert-butyl compounds were measured in CCl_4, $CHCl_3$, and CCl_4-pyridine solvents. In $CHCl_3$ and CCl_4 solutions the alkyl groups caused an increase in the C≡N intensity in the inductive order. This order was essentially absent in the mixed solvent containing 16% pyridine. The inverse order of intensities was found in CCl_4 and $CHCl_3$ rather than that which was expected from the correlation of the electrophilic substituent constants (σ^+) for the p-alkyl groups to the square root of the intensity. In the more basic mixed solvent, the changes in relative values were in the direction of the Baker-Nathan order. An attempt was made to estimate the quantities involved in the expression derived for the intensities from the observed dipole moment of the molecule. Essentially all of the intensity variation in the alkylbenzonitriles were reasonably accounted for by considering the polarizabilities of the alkyl groups. The conclusion is drawn that the intensity variations in CCl_4 can be explained without recourse to a hyperconjugation mechanism.

Noyes Chemical Lab., U. of Illinois, Urbana.
SOME PROPERTIES OF p-ALKYLBENZONITRILES AND ACETOPHENONES, by Theodore L. Brown. Final rept. on Contract Nonr-2533(00). 10 Aug 59, 4p. 3 refs.
Order from LC mi$1.80, ph$1.80 PB 148 128

The purpose of this study was to gain additional information which might be helpful in assessing the importance of C-H hyperconjugative electron release in determining the electronic properties of alkyl groups.

Ohio State U. Research Foundation, Columbus.
FUNDAMENTAL RESEARCHES IN THE LONG WAVELENGTH X-RAY REGION, by C. H. Shaw. T Technical rept. no. 8 on Contract N6onr-225(21). June 58, 13p. 25 refs. AD-161 665.
Order from LC mi$2.40, ph$3.30 PB 146 600

A brief summary of work concerned with x-ray investi gations of the structure and other fundamental physical properties of matter. It has long been recognized that an understanding of these properties ultimately rests upon a knowledge of atomic and electronic structure. Included in the report are:
Geometry of the two-crystal x-ray spectrometer, by J. A. Soules, pub. in the Ohio Jnl. of Science 54:304, Sep 54
Design of differential x-ray filters for low-intensity scattering experiments, by Jack A. Soules, William L. Gordon, and C. H. Shaw, pub. in the Review of Scientific Instruments 27:12-14, Jan 56.

Ohio State U. Research Foundation, Columbus.
INFRARED EMISSION SPECTRA OF GASEOUS B_2O_3 AND B_2O_2. FREQUENCY ASSIGNMENT AND THERMAL FUNCTIONS, by D. White, D. E. Mann and others. Technical rept. no. 2 on Contract Nonr-495(12) June 59, 30p. 20 refs. AD-219 358.
Order from LC mi$2.70, ph$4.80 PB 149 258

The infrared emission spectra of gaseous B_2O_3 and B_2O_2 in the temperature range 1400-1800°K was studied in the region 700-4000 cm^{-1}. Three distinct bands were found for gaseous natural B_2O_3 at 2040, 1302 and 742 cm^{-1} and the B^{10}-B^{11} isotope shifts measured. From the isotope shift data and other considerations the B_2O_3 molecule was assigned a V structure in the C_{2v} symmetry class. A force constant analysis was made and a frequency assignment from which thermal functions were computed is given. The observed frequencies lead to force constants which are consistent with the high stability of the molecule. Only one emission band of gaseous B_2O_2, at 1890 cm^{-1}, was observed. Assuming a linear structure, $D_{\infty h}$, for this molecule, a frequency assignment and thermal functions were estimated. (Author)

Oregon State Coll., Corvallis.
THE RATE OF VIBRATIONAL DEACTIVATION BY THE SPECTROPHONE METHOD. I. CARBON MONOXIDE, by G. C. Turrell, W. D. Jones, and J. C. Decius. Technical rept. no. 3 on Contract Nonr-1286(03). 1 Aug 59, 31p. 21 refs. AD-225 317.
Order from LC mi$3.00, ph$6.30 PB 148 189

An apparatus for observing the pressure signal generated by an infrared beam traversing a gas sample has been constructed. This spectrophone uses a modulation frequency of 600 cps. and is capable of measuring changes in the time lag between the incident infrared energy and the pressure with an accuracy of about 5 μsec. It has been applied to the study of vibrational relaxation times for pure carbon monoxide, as well as mixtures with the infrared inert gases H_2, He, Ne, A, N_2. At one atmosphere and at room temperature, the relaxation time for pure CO is 190 μsec.; other values range from 1.5 μsec. for CO-H_2 collisions up to 370 μsec. for CO-A. These results are compared with relaxation times for CO at elevated temperatures found by other methods. A discussion of the validity of spectrophone results and some of the complications are included. (Author)

Stanford U., Calif.
ANALYSIS OF A MAGNETIC RESONANCE SPECTROMETER, by J. P. Goldsborough and M. Mandel. Rept. on Paramagnetic Resonance, Contract AF 18(603)131. June 60, 15p. 5 refs. Technical note no. 131-5; AFOSR-TN-60-533; AD-238 355.
Order from LC mi$2.40, ph$3.30 PB 148 412

This paper analyzes an electron paramagnetic resonance microwave bridge spectrometer and expressions are given for the relation between the signal and the imaginary part of the magnetic susceptibility. From these the conditions for maximum signal are obtained. The analysis is also applicable to many other types of magnetic resonance spectrometers. (Author)

University of Southern California, Los Angeles.
INFRARED REFLECTION SPECTRA: A CATALOGUE, by David A. Dows and J. L. Hollenberg. Technical rept. no. 3 on Vibrational Spectra of Crystals at Low Temperatures, Contract DA 04-495-ORD-900. 25 Mar 60, 15p. 1 ref. OOR rept. 1815.11-C.
Order from LC mi$2.40, ph$3.30 PB 148 432

A catalogue of reflection band shapes is presented which should be useful in (a) deciding whether reflection will be measureable in a given case, (b) semiquantitative estimation of maximum reflection intensities and widths, and (c) estimation of absolute intensities from observed reflection spectra.

University of Southern California. Engineering Center, Los Angeles.
TRANSPORT PHENOMENA OF A RAREFIED AND FULLY IONIZED GAS IN THE PRESENCE OF A STRONG MAGNETIC FIELD. PART II, by Toyoki Koga. Technical note on Contract AF 18(603)95. 12 Feb 60, 19p. 3 refs. USCEC rept. 56-210; AFOSR-TN-60-103; AD-233 080.
Order from LC mi$2.40, ph$3.30 PB 146 719

Washington U., Seattle.
s-TETRAZINE I. ELECTRONIC ADSORPTION SPECTRA AND, IN PARTICULAR, THE VISIBLE $n \rightarrow \pi^*$ VIBRONIC BAND SYSTEMS UNDER HIGH RESOLUTION, by Glenn H. Spencer, Jr. (Doctoral thesis), Paul C. Cross, and Kenneth B. Wiberg. Technical note 3 on Contract AF 18(600)1522. Jan 60, 38p. 38 refs. AFOSR-TN-60-69; AD-233 496.
Order from LC mi$3.00, ph$6.30 PB 146 746

The low resolution electronic spectrum of s-tetrazine vapor was measured down to about 190 mμ, and the complex systems of vibronic bands that comprise the $n \rightarrow \pi^*$ visible absorption spectrum were studied under higher resolution. These latter spectra were photoelectrically recorded in the third order of a 21 ft grating spectrograph, using path lengths from 0.05 to 48 m and temperatures from -70 to 70°C. In the absorption regions 4500 to 6100 Å, the spectrum consists of over 500 sharp, vibronic band peaks. Their collected Q-branch maxima were measured to the nearest cm^{-1}, but no discrete rovibronic structure was resolved. (Author)

Washington U., Seattle.
s-TETRAZINE II. INFRARED SPECTRA, by Glenn H. Spencer, Jr. (Doctoral thesis), Paul C. Cross, and Kenneth B. Wiberg. Technical note 4 on Contract AF 18(600)1522. Jan 60, 21p. 22 refs. AFOSR-TN-60-68; AD-233 513.
Order from LC mi$2.70, ph$4.80 PB 146 747

To aid in the vibronic analysis of the $n \rightarrow \pi^*$ visible absorption band systems of s-tetrazine vapor, infrared spectra of vapor, solution, and cold, solid film phases of natural and of deuterated mixtures of s-tetrazine have been obtained. By use of the product rule and by correlation of the fundamental modes of s-tetrazine with those of benzene and the other azines, it is possible to make tentative vibrational assignments for all seven of the fundamental bands that would be expected to be infrared active in the wavelength region from 2 to 15. However, the low frequency modes 16a and 16b, A_{μ} and $B_{1\mu}$, respectively, have not yet been observed, and the lack of knowledge of the frequencies of eight of the nine gerade modes (Raman active only) has prevented any definite assignment of combination bands. The interesting, peculiar observation of what is believed to be the totally symmetrical mode 6a near 730 $cm.^{-1}$ in the solid film spectra of the various deuterated mixtures is also reported. (Author) (See also PB 146 746)

Optics

Army Chemical Warfare Labs., Army Chemical Center, Md.
THE FABRICATION OF INFRARED FILTER WHEELS USING SPRAY TECHNIQUES, by Hugh R. Carlon. 31 Dec 58, 11p. 1 ref. CWL Technical memo. 32-39; AD-208 394.
Order from LC mi$2.40, ph$3.30 PB 148 445

The present model E33R2 LOPAIR instrument employs a monochromator for wavelength selection, but an instrument has been successfully demonstrated which utilizes a rotating wheel, consisting of two semicircles of selected filter materials, which alternately transmit and block radiation at the reference and analytical wavelengths, thus producing an AC signal when an absorption occurs. These filter wheels have previously been manufactured by the process of vacuum evaporation, which is tedious and time-consuming. The spray techniques described here yield filter surfaces of equal quality to those obtained by vacuum evaporation, yet require only a fraction of the time. In addition, the spray process has certain advantages which make it a very flexible method of fabrication. (Author)

Cornell U., Ithaca, N. Y.
A PHOTON-COUNTING SPECTROMETER FOR ATTENUATION MEASUREMENTS IN THE SOFT X-RAY REGION, by D. H. Tomboulian. Technical rept. on Contract Nonr-401(37). Sep 59, 21p. 6 refs. AD-226 163.
Order from LC mi$2.70, ph$4.80 PB 148 872

Diamond Ordnance Fuze Labs., Washington, D. C.
THE QUASI-PARALLEL LIGHT PRINCIPLE: FORMATION OF HOLLOW-CONICAL, FLAT, OR TUBULAR OPTICAL PATTERNS, by Harald W. Straub, Josef M. Arthaber, and Ward J. Moore. 13 Jan 60, 15p. TR-745; AD-232 434.
Order from LC mi$2.40, ph$3.30 PB 146 301

A light beam whose boundary rays are truly parallel for a limited, but relatively large distance, is discussed. Parallel boundary rays were obtained when the parameters of the optical system were chosen so that a real image of an extended source is formed not at infinity but at a finite distance, and this image is equal in size to the lens or mirror that projects the image. This beam can be converted to the pattern of a well defined hollow cone, a tube or an equally well defined thin, flat sheet without using nonconventional optical means. The reversal of the principle, that is, replacement of the source by a photodetector, leads to detection patterns which may be relatively narrow for a given distance, or thin-walled hollow cones, or tabular, or thin flat sheets. This method for forming quasi-parallel, flat; and tabular patterns not only avoids the necessity of nonconventional optical parts but also affords good definition of the pattern as well as optical gain especially in the near field.

Naval Research Lab., Washington, D. C.
INFRARED TRANSMISSION OF THE ATMOSPHERE, by H. W. Yates and J. H. Taylor. Final rept. 8 June 60, 43p. 22 refs. NRL rept. 5453.
Order from LC mi$3.30, ph$7.80 PB 144 636

The transmission of the atmosphere in the spectral range from 0.5 to 15 μ has been studied over three sea-level paths 0.3, 5.5, and 16.25 km in length, with an average spectral resolution, $\lambda/\Delta\lambda$, of 300. The conditions encountered covered a wide range, from 0.11 cm precipitable water in the 0.3-km path to a maximum of 38 cm precipitable water in the 16.25-km path, and values of the visual scattering coefficient were measured from 0.048 km^{-1} to 0.24 km^{-1}. Data have been evaluated on selective transmission vs water-vapor concentration for the infrared "window" regions, and the behavior of the scattering coefficient with wavelength has been plotted for representative atmospheres. Similar data were plotted for several measurements made over a range of 27.7 km at an altitude of 10,000 ft. (Author)

Ohio State U. Research Foundation, Columbus.
ECHELETTE GRATINGS AS FILTERS, by Ely E. Bell and Robert A. Oetjen. Scientific rept. no. 1 on Contract AF 19(604)4119. July 59, 19p. 7 refs. AFCRC-TN-59-668; AD-231 891.
Order from LC mi$2.40, ph$3.30 PB 149 257

In the existing far infrared spectrograph at Ohio State University, echelette gratings were used for filtering when investigating radiation of wavelength greater than about 70μ. However, little detailed information about the reflection characteristics of these gratings was available. Therefore, with an eye to improving the filtering in this instrument at these longer wavelengths, the following were undertaken: (1) A calculation of the reflection characteristics, hence the filtering properties, of an ideal echelette grating; (2) A measurement of the reflection characteristics of some actual gratings and comparison with the ideal; and (3) An investigation of the possibility of finding a combination of gratings that would provide filtering more efficient than that now used. (Author)

Scripps Institution of Oceanography, U. of California La Jolla.
CORRELATION BETWEEN MEASURED PATH FUNCTION AND RELATIVE HUMIDITY, by Almerian R. Boileau. Rept. on Contract NObs-79092. 1 Feb 59, 34p. 16 refs. SIO Reference 59-5; AD-212 741.
Order from LC mi$3.00, ph$6.30 PB 148 853

This report describes the results of data gathered from a second formation flight of two airplanes, the instrumented B-29 and a microwave refractometer-equipped C-131 from Patrick Air Force Base squadron

Wayne State U., Detroit, Mich.
THEORETICAL INVESTIGATIONS ON THE LIGHT SCATTERING OF COLLOIDAL SPHERES. VIII. THE ANGULAR LOCATION OF INTENSITY MAXIMA AND MINIMA IN THE RADIATION DIAGRAM OF COLLOIDAL SPHERES, by Masayuki Nakagaki and Wilfried Heller. Technical rept. no. 33 on Contract Nonr-736(00). 20 June 59, 31p. 17 refs. AD-219 587.
Order from LC mi$3.00, ph$6.30 PB 146 351

The angular position of scattering maxima and minima in the radiation diagram of nonabsorbing colloidal spheres is calculated for $(m-1) \rightarrow 0$ and for $m \geq 1.20$, using in the former case the Rayleigh-Gans approximation and in the latter the exact Mie scattering functions. By means of empirical equations based upon the discrepancies between the Rayleigh-Gans data and the Mie data, the approximate location of scattering maxima and minima is calculated also for the m-values 1.05, 1.10, 1.15, 1.25, and 1.30. The expected precision and accuracy of particle size determinations from the angular location of scattering maxima and minima is discussed and the minimum angular ranges to be covered in a given instance are defined. A few pertinent features of the related La Mer method (HOTS) are briefly discussed. (Author)

Solid State Physics

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
AN INVESTIGATION OF THE QUESTION OF FIBER ORIENTATION IN THIN IRON FILMS, by Roger W. Clapp, Jr. 28 Sep 59, 18p. ARGMA TR-1C33R; AD-227 426.
Order from LC mi$2.40, ph$3.30 PB 148 356

Iron films, in the thickness range 20 to 250Å, were condensed from the vapor phase onto Formvar or baked-out silica substrates at temperatures less than 50°C. The films were sufficiently thin to permit study of the film-substrate combination by means of transmission electron diffraction. No fiber orientation was

observed for films deposited in vacuum (10^{-5}mm) or in helium at pressures of 10^{-2} mm or 10^{-1} mm. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
GENERAL FORMULAE FOR THE TRANSFORMATION OF THE ELASTIC, PIEZOELECTRIC AND DIELECTRIC CONSTANTS, by R. Bechmann.
15 May 59, 92p. 6 refs. USASRDL technical rept. 2051; AD-220 104.
Order from LC mi$5.40, ph$15.30 PB 148 113

The well-known elastic, piezoelectric and dielectric constants of anisotropic media are tabulated. A new form for the transformations of elastic and piezoelectric constants was derived. These transformations are presented in the form of tables. (Author)

Brown U., Providence, R. I.
RESEARCH DIRECTED TOWARD THE INVESTIGATION OF SILICON AND SILICON-CARBIDE SURFACES, by J. A. Dillon, Jr. and R. M. Oman.
Final scientific rept. for 1 Oct 58-30 Sep 59 on Contract AF 19(604)4568. [1959] 37p. 38 refs. AFCRC-TR-59-199; AD-228 984.
Order from LC mi$3.00, ph$6.30 PB 146 388

Contents:
Ion-bombardment etching of silicon and germanium
Low pressure experiments
High pressure experiments
Thermal etching of silicon crystals
Experimental arrangement
Results of heating at intermediate pressure
The interaction oxygen with silicon-carbide crystals
High vacuum experiments
High pressure experiments
Intermediate pressure experiments
Silicon-carbide surfaces
Gross surface properties of natural crystals
Asymmetry in atomic species
Chemical etching
Point-contact rectification measurements
Correlation of etching behavior with adsorption rate
(See also AD-225 651)

Cambridge U. (Gt. Brit.)
EFFECT OF STRAIN-RATE ON THE FLOW-STRESS OF f.c.c. METALS, by P. B. Hirsch, T. E. Mitchell, and P. R. Thornton. Annual summary rept. no. 1 on Contract AF 61(052)98. Oct 59, 43p. 18 refs. AFOSR-TN-60-152; AD-234 224.
Order from LC mi$3.30, ph$7.80 PB 147 335

The initial results of an experimental study of the reversible flow-stress change which occurs when the strain-rate is increased by a factor of ten during a tensile test of a f.c.c. metal are presented. Polycrystalline α-brasses and polycrystalline neutron irradiated Cu were studied as a function of deformation from 4.2°k to 300°k. Single crystals of pure Cu and of 70/30 α-brass were also studied in the same manner.

Illinois Inst. of Tech., Chicago.
AN X-RAY DIFFRACTION STUDY OF CRYSTAL PERFECTION IN SILICON, by Robert H. Bragg and Leonid V. Azaroff. Rept. on Contract AF 49(638)425. 24 June 60, 8p. 6 refs. AFOSR-TN-60-632.
Order from LC mi$1.80, ph$1.80 PB 148 778

The results of a preliminary study of the perfection of single crystals of Si is described. A modified Laue focussing arrangement was used to examine neighboring regions of a relatively perfect slice taken out of a Si ingot. Small variations in the line-width and the total diffracted intensity were observed for regions separated by about two millimeters. It also turned out that only short-wavelength x-radiation could show up small differences in crystal perfection. Some of the implications of this study and comparison to etch-pit determinations are also described. (Author)

Illinois U., Urbana.
PHOTOREPRODUCTION OF H CENTERS AT 15°K, by Jack Kingsley. Technical note no. 1 on Contract AF 49(638)529. May 60, 6p. 4 refs. AFOSR-TN-60-634.
Order from LC mi$1.80, ph$1.80 PB 148 772

Madrid U. (Spain).
STUDIES ON POLYMORPHISM IN SINGLE CRYSTALS, by J. L. Amoros. Final technical rept. for 1 Mar 59-29 Feb 60 on Contract DA 91-591-EUC-1084. [1960] 87p. 87 refs. AD-235 150.
Order from LC mi$4.80, ph$13.80 PB 147 253

The study of certain crystal transformations was carried out and certain techniques were accommodated to the required conditions of the research. One completed piece of work is presented: the work on the mechanism of the transition IV - II in NH_4NO_3. A second one is presented in preliminary form: the work on the study of diffuse scattering during the paraferroelectric transition of $NaNO_2$ and that of $NaNO_3$. With these 2 research pieces it was intended to get a direct knowledge of crystal transitions of two very different types: a first and second order transitions.

Manufacturing Labs., Inc., Cambridge, Mass.
THE LATTICE STABILITY OF METALS. I. TITANIUM AND ZIRCONIUM, by Larry Kaufman. Technical rept. no. 1 on [Contract Nonr-2600(00)]. 1 Oct 58, 40p. 36 refs.
Order from LC mi$3.00, ph$6.30 PB 148 794

The difference in free energy between the b. c. c. and h. c. p. modifications of titanium and zirconium have been calculated between 0°K and 2000°K by using existing thermodynamic data. These results have been employed to investigate the energetics of the b. c. c.⇌h. c. p. reactions in the Ti-Zr system and in a series of titanium-base alloy systems. It is found that the chemical driving force for martensitic b. c. c.→h. c. p. reactions in these systems is about 50 cal/mol. This value, compared to 300 cal/mol for iron-base alloys, can be explained by the difference in physical characteristics of martensitic transformations in iron-base and in titanium-base alloys. A method is suggested for estimating M_S vs. composition curves

for titanium and zirconium-base systems where such data are presently unavailable. (Author)

Maryland U., College Park.
THE ROTATION OF DIATOMIC MOLECULES IN MOLECULAR CRYSTALS, by Barbara Castle Kohin. Doctoral thesis. Rept. on Contract AF 49(638)399. Jan 60, 81p. 37 refs. Physics Dept. Technical rept. no. 164; AFOSR TN-60-58; AD-233 579.
Order from LC mi$4.80, ph$13.80 PB 146 677

Molecular rotation in crystals of N_2 and CO is investigated. The following contributions to the crystal field hindering free rotation are taken into account: (1) the interaction of the molecular quadrupoles, (2) the effect of the anisotropic molecular polarizabilities, and (3) the asymmetry in the short-range repulsive forces.

Massachusetts Inst. of Tech., Cambridge.
THE EFFECT OF PLASTIC STRAIN RATE ON DIFFUSION IN ALUMINUM-ZINC ALLOYS, by G. A. Bruggeman, M. Cohen, and B. L. Averbach. Rept. on Solid State Research and Properties of Matter, Contract AF 33(616)3264. Apr 60, 51p. 21 refs. WADD Technical rept. 60-218.
Order from OTS $1.50 PB 161 884

The effect of compressive strain-rate on interdiffusion and zinc self-diffusion in aluminum-zinc alloys has been investigated. At a strain rate of $2 \times 10^{-4} sec^{-1}$, the interdiffusion coefficient is increased by factors of 20, 13, and 8 at 375, 415, and 450°C respectively. At comparable strain rates, little enhancement of self-diffusion is detected. Quasi-hydrostatic pressure causes the interdiffusion coefficient to decrease much more than predicted theoretically. Factors are suggested which could account for the results, but existing uncertainties preclude a precise interpretation. (Author)

Materials Research Lab., Watertown Arsenal, Mass.
THE EFFECT OF CRYSTALLINE FIELDS ON CHARGE DENSITIES AND MAGNETIC FORM FACTORS, by A. J. Freeman and R. E. Watson. Jan 60, 17p. 14 refs. MRL rept. no. 70; AD-235 053.
Order from LC mi$2.40, ph$3.30 PB 146 967

The effects of crystalline fields on 3d charge densities and magnetic form factors for transition metal ions are discussed. It is shown that the crystalline field has two effects on the free ion 3d wave functions; (1) a differentiation or "splitting" of the two types of cubic 3d functions by an expansion of the t_{2g} (e_g) orbitals and a contraction of the e_g (t_{2g}) orbitals resulting in two different radial charge densities and (2) a net expansion of the charge distribution from the free ion value. The magnetic form factors due to this "splitting" effect when calculated according to the methods of Weiss and Freeman show measurable deviations from the free atom results. A form factor for Mn^{+2} based on optical absorption data shows a large expansion of the 3d charge density, in agreement with experiment. (Author)

Materials Research Lab., Watertown Arsenal, Mass.
RADIATION-ENHANCED HELIUM PRECIPITATION IN COPPER, by A. N. Goland. Feb 60, 7p. 3 refs. Rept. no. 73; AD-237 988.
Order from LC mi$1.80, ph$1.80 PB 148 201

Visual observation of radiation-enhanced diffusion has been accomplished by metallographic examination of the precipitation of helium in neutron-irradiated copper. Helium was injected into copper specimens by alpha-particle bombardment and vacancies were then introduced into some of the specimens by fast neutron irradiation. With both types of specimens held at temperatures high enough for diffusion to occur (425°C), considerably more precipitation was visible in the neutron-irradiated specimens than those not irradiated. Thus illustrating the enhancement of diffusion by radiation-induced excess vacancies. (Author)

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
THEORY OF D FOR SELF-DIFFUSION IN SOLID METALS, by G. M. Pound, W. R. Bitler, and H. W. Paxton. Rept. on Contract Nonr-760(08). [1959] 17p. 30 refs.
Order from LC mi$2.40, ph$3.30 PB 148 570

The kinetics of diffusion in solids is treated in terms of statistical mechanics from the point of view of absolute rate theory. An approximate description of the activated state leads to the conclusion that in the two degrees of freedom orthogonal to the jump direction only the lower vibrational energy levels are occupied. This circumstance gives rise to a negative contribution to the experimental entropy of activation for diffusion in solids which is negligible for the vacancy mechanism but very appreciable for the ring mechanism. It is suggested that a low D_o, perhaps of the order of 10^{-3} cm^2/sec, is an experimental criterion tor 4-atom ring diffusion and that the self-diffusion in pure chromium and uranium (b.c.c.) occurs by this mechanism. Further, a low Arrhenius frequency factor is predicted for all processes in solids which require simultaneous jump of n atoms, e.g. in the thermally activated movement of dislocation loops. (Author)

Minerals Research Lab., U. of California, Berkeley
A STUDY OF LOW TEMPERATURE CREEP MECHANISMS IN ALUMINUM SINGLE CRYSTALS, by L. A Shepherd and J. E. Dorn. Technical rept. no. 8 on Contract Nonr-222(49). 18 Sep 59, 54p. 27 refs. Series no. 103; issue no. 8.
Order from LC mi$3.60, ph$9.30 PB 148 896

A study was made of the effects of small abrupt changes in stress and temperature upon the creep rate of aluminum single crystals at low temperatures. With an important exception, the results were found to be in agreement with the predictions of the dislocation intersection mechanisms. Whereas intersection theory predicts that the change in the logarithm of the strain rate with stress,

$$\beta = \frac{\partial \ln \dot{\varepsilon}}{\partial \tau} = \frac{const}{kt} ,$$

β was found experimentally to increase by a factor of 5 between 78° and 160°K. A qualitative model is offered to explain this behavior in terms of pile-ups of dislocations aiding intersection at the higher temperature. (Author)

Naval Ordnance Lab., White Oak, Md.
MAGNETIC MATERIALS, by Louis R. Maxwell. 12 Jan 59, 34p. NAVORD rept. 6263; AD-225 661.
Order from LC mi$3.00, ph$6.30 PB 148 453

The free atom of the transition metals which possesses uncompensated electron spins is the elementary magnet with which ferromagnetism and ferrimagnetism is developed. The various types of magnetic materials and their important properties can be interpreted in terms of the free atom and its local atomic environment. High permeability, square loop materials, and special functional materials existing as alloys are discussed. Interesting examples of domain wall motion in iron whiskers are included. When the magnetic ions find themselves in a spinel environment the properties change to that described as ferrimagnetism. Various basic properties of ferrimagnetism are given including an example of the development of permanent magnetic materials having low symmetry as in the case of ferrooxdure. The garnets are described where the magnetic ions find themselves in three different sites. Recent work on the transparent properties of garnets and certain ferrites are presented showing unusual photographs of domain walls. Further basic developments and applications of magnetic materials are included which cover effects due to neutron irradiation. (Author)

New York U., N. Y.
STOICHIOMETRY AND ELECTRONIC PROPERTIES OF PbTe, by Edward Miller, Kurt K. Komarek, and Irving B. Cadoff. Rept. for 1 Dec 56-30 Sep 59 on Solid State Research and Properties of Matter, Contract AF 33(616)3883. Dec 59, 39p. 35 refs. WADC Technical rept. 59-570.
Order from OTS $1.00 PB 161 842

Off-stoichiometric single crystals of PbTe were grown by the Bridgman technique at a solidification rate of 0.35 cm/hr. At this low solidification rate the crystals were longitudinally segregated, the composition at any point corresponding to that dictated by the solidus curve of the phase diagram. The phase diagram shows that PbTe has an off-stoichiometric melting point; the difference in concentration between the maximum melting point and the stoichiometric point being 0.002 atomic percent, with the congruent melting point on the tellurium rich side of the stoichiometric point. Stoichiometric PbTe is in equilibrium with liquid 0.41 weight percent rich in lead, the equilibrium temperature being 923.2°C. The solubility of both lead and tellurium in PbTe is restricted, the maximum lead and tellurium excess being 5×10^{19} atoms/cm^3. The crystals were cut into thin sections perpendicular to the growth direction and the slices homogenized to yield samples of different impurity concentrations of lead or tellurium. Resistivity, Hall coefficient, and thermoelectric power measurements were made as a function of temperature on three slices corresponding to stoichiometric, excess lead, and excess tellurium. (Author)

Purdue Research Foundation, Lafayette, Ind.
SEMICONDUCTOR RESEARCH. Quarterly rept. no. 12, 1 May-31 July 59, on Contract DA 36-039-sc-71131. [1959] 36p. 14 refs. PRF 1258; AD-230 803.
Order from LC mi$3.00, ph$6.30 PB 146 998

Contents:
Defect crystals, by H. M. James and B. V. Paranjape
Choice of gauge in perturbation theory, by H. M. James and K. S. Mendelson
Transport properties in extrinsic tellurium, by V. A. Johnson and P. Skadron
Preparation and analyses of semiconductors, by L. Roth
Heat capacity of n-type germanium below 1 deg K, by P. H. Keesom and C. A. Bryant
The transport properties of semiconductors at low temperatures, by J. F. Goff and N. Pearlman
Magnetic susceptibility, by D. H. Damon and A. N. Gerritsen
Infrared absorption in irradiated silicon, by A. K. Ramdas and H. Y. Fan
1 cm electron spin resonance spectrometer, by M. Nisenoff, and W. Jung, H. Y. Fan
Paramagnetic resonance in neutron-irradiated silicon, by M. Nisenoff and H. Y. Fan
Impurity conduction in silicon, by R. K. Ray and H. Y. Fan
Dependence of mobility of hot carriers on carrier concentration, by D. Brown and R. Bray.
(See also PB 145 883)

Raytheon Co., Waltham, Mass.
BETA SILICON CARBIDE, by D. M. Warschauer. Scientific rept. no. 1 on Contract AF 19(604)6133. 25 Apr 60, 35p. 6 refs. AFCRC-TN-60-555.
Order from LC mi$3.00, ph$6.30 PB 148 354

The results of tests for the optimum composition of gas for the vapor-decomposition method of growth indicate that best results are achieved when hydrogen and silicon tetrachloride are used alone, rather than with addition of a carbon-bearing compound. The best crystals have been grown at 1950°C; these crystals are stoichiometric to within 0.3 percent, and the impurity content does not exceed 0.003 percent of the impurity most abundant. It has been demonstrated that formation of methane and of high-molecular weight complexes of silicon dichloride are important factors in the growth process. Somewhat smaller crystals of a different shape are being grown by deposition from solution; advances have been in improving the purity of this material, and preliminary measurements of electrical properties are under way. (Author)

Sheffield U. (Gt. Brit.)
ELECTRONIC WAVE FUNCTIONS IN PERTURBED METAL LATTICES, by N. H. March and A. M. Murray. Final technical rept. no. 2, 1 May 59-30 Apr 60, on Contract DA 91-591-EUC-1090. [1960] 41p. 13 refs.
Order from LC mi$3.30, ph$7.80 PB 148 520

The calculation of electronic wave functions round a vacancy in a finite metal has been completed, and the final results are reported here. Calculations are described for particle numbers of approximately

2×10^2, 2×10^3 and 10^9. A self-consistent von Weizsäcker calculation is also reported, and comparison made between this, the finite metal results, and existing Thomas-Fermi calculations. Calculations also reveal long-range oscillations in the total perturbed electron density for finite metals. Reference is made to a number of applications of the present results. Results obtained by a density matrix approach to the imperfections problem are discussed. (See also PB 143 112)

Stanford Electronics Labs., Stanford U., Calif.
SPECTRAL RESPONSE OF SOLAR CELL STRUCTURES, by L. M. Terman. Rept. on Contract Nonr-225(31). 21 Sep 59, 25p. 3 refs. Technical rept. no. 1605-1; AD-226 436.
Order from LC mi$2.70, ph$4.80 PB 148 597

The purpose of this study was to measure the spectral response of silicon solar cell structures, and to observe how the response varied with the depth of the p-n junction. Spectral response was defined as the relative short-circuit current as a function of the wavelength of incident light for equal energy incident upon the cell at all wavelengths. Cells were made with the junction depths varying from 0.6 to 5.0μ, and having smooth (etched) surfaces and rough (lapped) surfaces. Response curves from these cells are presented. These curves indicate that in order to increase the relative short-wavelength response ($\lambda < 0.75\mu$) the junction should be made closer to the surface, while in order to increase the relative long-wavelength response ($\lambda > 0.75\mu$) the junction must be made comparatively far below the surface. The effect of having a lapped surface on the cell is to reduce the lifetime near the surface, thus reducing the response to short wavelengths of incident light. A simple theoretical model is then presented which appears to adequately describe the mechanism involved in determining the shape of the response curves. (Author)

Sylvania Electronic Systems, Waltham, Mass.
INVESTIGATION OF SOME SEMICONDUCTOR SWITCHING ELEMENTS AND THEIR APPLICATION TO A SINGLE-POLE, EIGHT-THROW SWITCH, by Stephen N. Miller. Rept. on Contract AF 19(604)5474 1 Apr 60, 70p. 20 refs. Scientific rept. SR424-2; AFCRC-TN-60-399.
Order from LC mi$3.90, ph$10.80 PB 148 562

A four-terminal, T-network, equivalent circuit impedance representation is presented which satisfactorily predicts the microwave switching properties of three germanium diodes in single-pole, single-throw switches at 2.0, 3.0, and 4.0 kmc. Typical characteristics of these switches are average insertion loss $\leq$ 1.9 decibels, average switching ratio $>$ 15 decibels, and 10-percent to 90-percent power level changes of $T_{on} \leq 40$ nanoseconds, and $T_{off} = 20$ nanoseconds, all over a 5:1 frequency band to 4.0 kmc. General design formulas for a multithrow switch at three frequencies with satisfactory results. Performance data is presented for the eight-throw switch over a 5:1 band to 4.0 kmc. Compared to the SPST switch, some improvement in switching ratio and degradation in insertion loss are noted.

Wayne State U., Detroit, Mich.
THE ARC IMAGE FURNACE FOR GROWING SEMICONDUCTOR CRYSTALS, by R. P. Poplawsky and J. E. Thomas, Jr. Technical note no. 3 on Contract AF 49(638)158. 1 Mar 60, 116p. 36 refs. AFOSR-TN-60-312.
Order from OTS $2.50 PB 161 868

The optical, mechanical, and electrical details of an arc image furnace are given. This furnace uses two 60" paraboloidal reflectors in vertical arrangement with a high intensity carbon arc as the source. It was designed to study "arc image" crystal growing techniques. Two crucible-free techniques, "pushing" and "pulling", which resulted in the growth of several arc image silicon crystals are discussed. Pushing a silicon crystal consists of melting the top surface of a single crystal seed disk, which is positioned at the image point of the furnace, and then feeding a long, small diameter, polycrystalline rod into this melt. Pulling a silicon crystal is accomplished by first dipping a small rectangular seed crystal into a melt produced on the top surface of a relatively large, polycrystalline, silicon cylinder. The seed is then slowly withdrawn and liquid material solidifies onto it. The results of measurements made on pushed and pulled silicon crystals show that they are essentially free of oxygen, have high resistivities when a good grade of bulk material is used, and have a dislocation density of the order of 10^4 cm.$^{-2}$. The factors which influence the growth and quality of arc image crystals are discussed. These include: maximum useful furnace power, shapes of floating zones, and radiant flux considerations.

Wayne State U., Detroit, Mich.
OBSERVATIONS OF SURFACE TRANSVERSE MAGNETORESISTANCE EFFECTS ON N-TYPE GERMANIUM, by Walter A. Albers, Jr. and J. E. Thomas, Jr. Technical note no. 2 on Contract AF 49(638)158. 1 Mar 60, 94p. 35 refs. AFOSR-TN-60-313.
Order from LC mi$5.40, ph$15.30 PB 148 762

Two techniques were developed for preparing large surface-to-volume ratio single crystal samples for surface studies. In both cases the methods depend on having, initially, thick slices of semiconductor single crystal material. This material is then either (1) made the anode of an electrolytic cell and illuminated with near-infrared so that the sample etches thin in the illuminated region or (2) is exposed to a flowing stream of an acid mixture and is subsequently etched thin by the resulting chemical reactions. Several thin samples of n-type germanium were prepared. The electrical conductivity and the magnetoresistance of these samples were simultaneously measured as a function of the surface conditions of the sample.

Wayne State U., Detroit, Mich.
SURFACE PHENOMENA IN SEMICONDUCTORS AND GROWTH OF SEMICONDUCTOR CRYSTALS, by W. A. Albers, V. E. Noble and others. Technical rept. on Contract AF 49(638)158. 1 Mar 60, 41p. 14 refs. AFOSR-TR-60-41.
Order from OTS $1.25 PB 161 867

A photo-electric etching technique has been developed for the preparation of thin filaments of single crystal

germanium. Magneto-resistance measurements made on these thin samples have yielded one of the first direct observations of the mobility of electrical carriers near the surface of a semiconductor. 1/f noise measurements have been made upon the thin filaments in order to relate the semiconductor surface properties to the process of carrier trapping by surface energy states. The problem of preparing hyper-pure crystals of semiconducting materials was attacked by employing a high intensity carbon arc. An interpretation of the results of vertical liquid zone and irradiance profile calculations, has indicated the feasibility of growing large, good quality crystals of the medium high melting point semiconductors using arc image techniques.

X-Ray and Crystal Analysis Lab., Pennsylvania State U., University Park.
CRYSTAL STRUCTURE RESEARCH BY X-RAY AND NEUTRON DIFFRACTION, by Ray Pepinsky. Final rept. for 1 June 57-14 Sep 58 on Contract DA 36-039-sc-72385. [1958] 88p. 18 refs. AD-208 071.
Order from LC mi$4.80, ph$13.80 PB 146 579

Many new ferroelectrics have been discovered, and the importance of the glycine molecule and of the tetrahedral ions such as NH_4^+ and SO_4^{--} in the ferroelectric transitions have been emphasized. An extensive study has been carried out on the various physical properties of ferroelectric sulfates as well as fluoberyllates. X-ray structure analysis of triglycine sulfate has shown the mechanism of ferroelectricity in this crystal.

Rutgers State U. Coll. of Engineering, New Brunswick, N. J.
ON THE MECHANICAL AND THERMAL STABILITY OF LOW-ANGLE BOUNDARIES IN ZINC SINGLE CRYSTALS, by Sigmund Weissmann, Makato Hirabayashi, and Hiroshi Fujita. Final rept. on Contract DA 30-069-ORD-1777. 1 May 60, 51p. 18 refs. OOR rept. 1665. 3-Met.
Order from LC mi$3.60, ph$9.30 PB 148 442

The mechanical and thermal stability of low-angle boundaries in zinc single crystals was studied by methods combining metallographic techniques with x-ray reflection microscopy and diffraction analysis. It was found that low-angle boundaries perpendicular to the basal plane do not offer any appreciable resistance to a shearing force parallel to the basel plane if they are pure tilt boundaries, but are substantial barriers if they are asymmetrical. If the external force exceeds a critical value these asymmetrical low-angle boundaries become sites where fracture may occur. The strengthening effect of the asymmetrical low-angle boundaries is attributed to the effective stress field of the screw dislocations, which are mechanically stabilized by the edge dislocations. The stress field of the screw dislocations is also responsible for the thermal instability of the asymmetrical low-angle boundaries, which on annealing are gradually converted into pure tilt boundaries. A coarse substructure established after annealing and consisting of pure tilt boundaries is thermally very stable. On solidification after partial melting of the crystal the coarse substructure is re-established, whereas the fine substructure is entirely modified. (Author)

Theoretical Physics

Avco-[Everett] Research Lab., Mass.
MAGNETOHYDRODYNAMIC DISTORTION OF A MAGNETIC FIELD DUE TO UNIFORM FLOW, by David S. Falk. Rept. on Contract AF 04(645)18. 30 Apr 58, 8p. Research rept. 29; AD-201 913.
Order from LC mi$1.80, ph$1.80 PB 147 195

An exact solution has been obtained for the distortion of the magnetic field of a straight wire of vanishing diameter, due to the uniform flow of a fluid with constant scalar conductivity, in the limit where the effect of the field on the flow is neglected.

Brandeis U., Waltham, Mass.
QUANTUM CORRECTED STATISTICAL METHOD, by L. C. R. Alfred. Technical rept. no. 7 on Contract Nonr-1677(01). Sep 59, 22p. 9 refs. AD-228 394.
Order from LC mi$2.70, ph$4.80 PB 148 595

Quantum corrections are applied to the single particle density matrix in a semiclassical ensemble where the distribution is unrestricted. A form for the density matrix containing implicitly a function of the wave mechanical Hamiltonian operator is devised. A formalism is then developed to decompose this operator function into effectively classical and nonclassical parts. The classical part corresponds to the semiclassical density matrix, and the quantum corrections are obtained from the nonclassical terms The quantum corrected density matrix for a spherically symmetrical and a 1 dimensional system were evaluated. The densities for a linear harmonic oscillator and a Coulomb potential for a Fermi-Dirac distribution were also examined. (Author)

California U., Berkeley.
ON FINITE RENORMALIZATION CONSTANTS AND THE MULTIPLICATION OF CAUSAL FUNCTIONS IN PERTURBATION THEORY, by H. J. Bremermann. Technical rept. no. 8 on Contract Nonr-222(62). Sep 59, 32p. 11 refs. AD-227 963.
Order from LC mi$3.00, ph$6.30 PB 148 583

Chicago U., Ill.
QUANTIZATION OF NON-LINEAR SYSTEMS, by I. E. Segal. Technical note no. 2 on Contract AF 49(638)666. May 60, 71p. 23 refs. AFOSR-TN-60-575.
Order from LC mi$4.50, ph$12.30 PB 148 416

A direct method of quantization, applicable to a given non-linear hyperbolic partial differential equation, is indicated. From such classical equations alone, without a given Lagrangian or Hamiltonian, or a priori linear reference system such as a bare or incoming field, a quantized field is constructed, satisfying the conventional commutation relations. While mathematically quite heuristic in part, local products of quantized fields do not intervene, and there are grounds for the belief that the formulation is free from non-trivial divergences. (Author)

Hebrew U. (Israel).
TABLES OF EIGENVALUES AND MATRIXELEMENTS OF TRANSITION PROBABILITIES FOR AN AXIAL SPIN HAMILTONIAN WITH S = 3/2, by R. Stahl-Brada and W. Low. Technical note no. 9 on Contract AF 61(052)59. July 59, 58p. 1 ref. AFOSR-TN-59-1125; AD-232 062.
Order from LC mi$3. 60, ph$9. 30 PB 146 717

Numerically computed eigenvalues of the matrix corresponding to the axial spin Hamiltonian $\mathcal{H}_s = g\beta H.S + D(S_z - \frac{1}{3} S(S+1))$ with the spin number S =3/2 are tabulated.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
THE WAVE MOTIONS OF SMALL AMPLITUDE IN A FULLY IONIZED PLASMA. PART II. WITH LONGITUDINAL APPLIED MAGNETIC FIELD, by S. I. Pai. Rept. on Contract AF 49(638)401. Apr 60, 30p. Technical note BN-207; AFOSR-TN-60-576.
Order from LC mi$2. 70, ph$4. 80 PB 148 211

Wave motions of infinitesimal amplitude in a fully ionized plasma, consisting of single charged ions and electrons, have been investigated by a two fluid theory under uniform external magnetic field. The interaction of the basic modes of wave due to external magnetic field has been discussed. The case where the external uniform magnetic field is in the direction of propagation of the waves has been analysed in detail. The effect of finite electrical conductivity on these transverse waves has been briefly discussed.

Institute of Mathematical Sciences, New York U., N. Y.
STATISTICAL MECHANICS AND THE BOLTZMANN EQUATION, by Robert M. Lewis. Rept. on Contract AF 49(638)341. Jan 60, 10p. 5 refs. Research rept. no. HT-4; AFOSR-TN-60-10; AD-233 307.
Order from LC mi$1. 80, ph$1. 80 PB 146 720

A very simple derivation of the Boltzmann equation is given. The derivation is based on the solution of the initial value problem for the hierarchy equations of statistical mechanics. (Author)

Institute of Optics, U. of Rochester, N. Y.
CORRELATION THEORY OF STATIONARY ELECTROMAGNETIC FIELDS. PART I: THE BASIC FIELD EQUATIONS, by E. Wolf and P. Roman (U. of Manchester). Technical note no. 1 on Contract AF 49(638)602. Oct 59, 22p. 8 refs. AFOSR TN-59-1188; AD-232 919.
Order from LC mi$2. 70, ph$4. 80 PB 146 336

In recent papers a class of second order correlation tensors was introduced and certain differential equations which govern their propagation were postulated. These correlation tensors, which may be regarded as natural generalizations of functions used in the analysis of partially coherent optical wavefields, characterize the correlations which exist between the electromagnetic field vectors at any 2 points in the field, at any 2 instants of time. A derivation of the basic differential equations is presented; and it is shown that the 2 sets into which equation naturally split are not independent, but follows from each other as a consequence of certain symmetry properties which the correlation tensors exhibit. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
HIGH ENERGY LIMIT OF FORM FACTORS, by S. D. Drell and F. Zachariasen. Technical note no. no. 13 on Contract AF 49(638)388. Feb 60, 20p. 8 refs. AFOSR TN-60-183; AD-233 743.
Order from LC mi$2. 40, ph$3. 30 PB 146 420

The following theorem is proved: for finite charge renormalization constant Z_3^{-1}, the form factors describing any vertex with 2 particles on the mass shell must vanish at infinite momentum transfer. The relation of this result to the work of Lehmann, Symanzik, and Zimmerman (Nuovo Cimento 2:425, 1955) is discussed. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
A TEST OF APPROXIMATION METHODS IN POTENTIAL SCATTERING, by J. D. Bjorken and A. Goldberg. Technical note. no. 11 on Contract AF 49(638)388. Feb 60, 24p. 11 refs. AFOSR-TN-60-167; AD-233 740.
Order from LC mi$2. 70, ph$4. 80 PB 146 419

Various approximation procedures fashionable in field theory for computing scattering amplitudes are tested on a soluble problem in potential theory---the s-wave scattering by an exponential potential. The methods include: (1) the Fredholm, or determinantal, expansion; (2) the Chew-Mandelstam procedure of constructing the scattering amplitude T_0 from analyticity properties and unitarity; (3) expansion of T_0 in powers of the potential strength λ (Born approximation); and (4) expansion of tan δ_0 in powers of λ, and (5) expansion of cot δ_0 in powers of λ.

Microwave Lab., Stanford U., Calif.
INVESTIGATION OF MICROWAVE PROPERTIES OF PLASMAS, by M. Chodorow. Scientific rept. no. 7, 1 Nov 59-31 Jan 60, on Contract AF 19(604)5226. Feb 60, 21p. M. L. rept. 697; AFCRC-TN-60-185.
Order from LC mi$2. 70, ph$4. 80 PB 148 168

Thermal Plasma: The major source of ion loss now appears to be from diffusion as well as from recombination. Noise in Plasmas: An analysis of the correlation measurement has been made, and simpler versions of the original experiment have been examined. Harmonic Generation in Plasmas: Theoretical work has been concerned with predicting the second harmonic output of a generator. Electron Beam Interaction with a Plasma: Numerical solutions Electron Plasma Waves: Propagation measurements on the enlarged plasma guide system. Parametric Effects: A re-examination of the theory of traveling-wave type parametric amplification in a plasma column has given some new insight on the rather marginal performance of the tubes used up to now. Electrostatic Sound Waves: Experiments attempting

to excite low-velocity plasma sound waves are described. Plasma Confinement: A new electrode configuration for imposing the rf field on the plasma confirmed earlier conclusions that the confinement phenomena is not a radiation pressure effect but more likely a sheath effect. Plasma Studies: This new project is presently concerned with two aspects of plasmas: analysis of nonlinear effects by Hamiltonian methods, and the investigation of a possible experiment to verify the concept of Landau damping. (See also PB 144 927)

Microwave Lab., Stanford U., Calif.
INVESTIGATION OF THE MICROWAVE PROPERTIES OF PLASMAS, by M. Chodorow. Scientific rept. no. 5, 1 Aug-31 Oct 59, on Contract AF 19(604)5226. Dec 59, 21p. M. L. rept. no. 669; AFCRC-TN-60-113; AD-233 580.
Order from LC mi$2.70, ph$4.80 PB 146 646

Contents:
Plasma research
Thermal plasma
Noise in plasmas
Harmonic generation in plasmas
Microwave measurements in plasmas
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Electron beam interaction with a plasma
Electron plasma waves
Parametric effects
Electrostatic sound waves
Plasma confinement

Microwave Lab., Stanford U., Calif.
LANDAU DAMPING OF CIRCUIT AND ION WAVES, by P. A. Sturrock. Technical note on Contract AF 49(638)415. Jan 60, 17p. 8 refs. M. L. rept. no. 665; AFOSR-TN-60-141; AD-233 751.
Order from LC mi$2.40, ph$3.30 PB 146 348

It is shown that the interaction of a slow circuit wave with the thermal electrons of a plasma column should lead to dissipation of the circuit wave by the mechanism of Landau damping. Numerical estimates indicate that this effect should be susceptible to experimental verification. Such an experiment, if successful, would offer a method for determining the electron velocity distribution of a plasma column. A circuit analogue for the ion-acoustic-wave mechanism is derived which facilitates calculation of the Landau damping of ion waves. This effect is found to be small and cannot account for the difficulty experienced in attempting to set up these waves. (Author)

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
RADIATION BY PLASMA OSCILLATIONS IN A BOUNDED PLASMA IN A MAGNETIC FIELD, by H. W. Wyld, Jr. 23 Oct 59, 28p. 3 refs. PRL-9-23.
Order from LC mi$2.70, ph$4.80 PB 147 000

The radiation by a thermal distribution of plasma oscillations in a bounded plasma in a magnetic field is calculated in the limit $(\omega_c/\omega_p)^{1/2} \ll 1$, where ω_c and ω_p are the cyclotron and plasma frequencies. The calculation is performed in two ways leading to the same result: (1) a "Fresnel formula" for the ratio of the intensity of the electromagnetic wave transmitted through the plasma boundary to the intensity of an incident plasma oscillation is derived; (2) the decaying modes, satisfying a radiation condition at infinity, of a bounded plasma in a magnetic field are found.

Purdue U., Lafayette, Ind.
ON THE POSSIBILITY OF THE CHARGE DEPENDENT CORRECTION TO THE GRAVITATIONAL FORCE, by Masaaki Kawaguchi. Rept. on Contract AF 18(600)1579. [1957] 5p. 6 refs. AFOSR-TN-58-189.
Order from LC mi$1.80, ph$1.80 PB 137 679

Sindel S. p. A., Rome (Italy).
MICROWAVE DETERMINATIONS OF AFTERGLOW TEMPERATURES AND ELECTRON COLLISION FREQUENCIES IN NITROGEN, by D. Formato and A. Gilardini. Technical scientific note no. 1 on Contract AF 61(052)39. 7 Aug 59, 15p. 9 refs. AFCRC-TN-60-149; AD-233 986.
Order from LC mi$2.40, ph$3.30 PB 146 644

A new method for measuring afterglow electron temperatures from microwave noise measurements is described. By using this method it was shown that the electron temperatures in the afterglow of a dc pulsed discharge in a long glass tube are much larger than thermal over the measured decay time. This may explain the different electron collision frequency values measured in nitrogen by different authors with microwave techniques. (Author)

Sperry Gyroscope Co., Great Neck, N. Y.
A BEAM-GENERATED BEAM-PLASMA SYSTEM, by C. C. Wang, J. E. Hopson, and L. P. Levine. Scientific rept. no. 1 on Contract AF 19(604)5555. Mar 60, 60p. 23 refs. Sperry rept. no. NA-8210-8191-1; AFCRC-TN-60-374.
Order from LC mi$3.60, ph$9.30 PB 148 316

The minimum pressure condition for plasma generation, the result of directing an electron beam through a residual gas (hydrogen in this study) along magnetic field lines, has been theoretically predicted and experimentally verified. For pressures greater than the minimum pressure, the equilibrium plasma density has been analyzed. Plasma growth greater than that expected from collisions of primary electrons with residual gas atoms was found; diffusion-controlled breakdown caused by a microwave generation process of the system explains this growth. Microwave interaction of the beam-generated plasma circuit with the primary beam is exhibited as a velocity modulation of the beam.

Experiments show a discrete bandwidth noise spectrum theoretically, discrete frequency oscillations over a prescribed bandwidth should be produced. Plasma circuit characteristics are not independent of microwave power level as assumed in the theory; the microwave power generated is apparently absorbed by the plasma. The plasma, then, is unstable. (Author)

Stevens Inst. of Tech., Hoboken, N. J.
INVESTIGATION OF PLASMA ACCELERATIONS, by K. C. Rogers, D. Finkelstein and others. Quarterly progress rept. no. 6, 1 Oct-31 Dec 59, on Megatron Accelerator, Contract DA 36-039-sc-78097. [1959] 23p. 16 refs. AD-233 991.
Order from LC mi$2.70, ph$4.80 PB 147 979

Some results of further theoretical work on the megatron beam are summarized. Possible instabilities are listed and stability criteria are given. The instabilities considered are single-particle magnetic guide field resonances, kink hydrodynamic instability, negative mass instability, and two stream instability. (Author)

Technische Hochschule, Munich (West Germany).
WAVE PROPAGATION IN A PLASMA-CABLE, by G. Biener. Technical final rept. for 1 Oct 57-30 Sep 59 on Contract AF 61(052)11. [1959] 43p. 9 refs. AFCRC-TR-60-110; AD-233 778.
Order from LC mi$3.30, ph$7.80 PB 146 637

In the case of a time-varying plasma when the gaseous discharge increases or decreases within a short time, probe measurements cannot always be carried out. For studying time-varying gaseous discharges the classic probe method was discarded in favor of electromagnetic waves whose propagation characteris tics will be influenced by the condition of the plasma. A phase measuring method was worked out, by which the phase difference between 2 different points of a progressing wave could be determined and which allows to observe time-varying processes in the gaseous discharge. By these 2 measuring methods (the wave and the probe method) the plasma parameters at stationary conditions were determined and wave propagation in the plasma cable was further investigated. By employing the phase difference method for these measurements it was possible to distinguish between a slow forward wave with a phase and group velocity of equal direction, and a backward wave with a phase and group velocity of opposite directions. Furthermore, the influence of the electronic drift velocity on the propagation was identified by experiments and quantitatively determined. (Author)

Watertown Arsenal Labs., Mass.
THE INTERACTION OF ELECTRONS WITH ELASTIC WAVES IN SOLIDS WITH RESPECT TO ULTRASONIC ATTENUATION, by E. P. Papadakis. May 60, 30p. 18 refs. WAL TR-143/32.
Order from LC mi$2.70, ph$4.80 PB 148 122

Theoretical and experimental work by many researchers show that the attenuation of ultrasonic elastic waves in metals at liquid helium temperatures is dependent upon the momentum transfer between the electrons and the lattice, the population of electrons in the normal- and superconducting states, and the orientation of the elastic displacement with respect to an applied magnetic field. The work is summarized and the results presented in equations and graphs. (Author)

Avco[Everett] Research Lab., Mass.
ELECTRICAL CONDUCTIVITY OF THERMALLY IONIZED AIR PRODUCED IN A SHOCK TUBE, by S. C. Lin. Rept. on Contract AF 04(645)18. Feb 57, 24p. 16 refs. Research rept. 5 (formerly Research note 26).
Order from LC mi$2.70, ph$4.80 PB 146 657

The electrical conductivity of shock-heated air at equilibrium temperature from 3500°K to 6200°K, and at densities of the order of 0.01 N. T. P., has been measured, using the shock wave-magnetic field interaction technique reported by Lin, Resler, and Kantrowitz.

Avco-Everett Research Lab., Mass.
GENERALIZED HEAT TRANSFER FORMULAE AND GRAPHS, by R. W. Detra and H. Hidalgo. Rept. on Contract AF 04(645)18. Mar 60, 19p. 8 refs. Research rept. 72; AD-233 702.
Order from LC mi$2.40, ph$3.30 PB 147 211

Utilizing the research results of previously reported investigations of the laminar, turbulent and radiative heat transfer in dissociated air, some generalized formulae for calculating heat transfer are given. Graphs for determining the laminar heat transfer, momentum thickness Reynolds number, and turbulent heat transfer distributions around an axisymmetric body are also given. These heat transfer correlations are valid for velocities between 6000 fps and 26,000 fps and for altitudes up to 250,000 ft. This range of velocities and altitudes covers the important re-entry regime of practical re-entry trajectories having interest today. These generalized results are specjalized for ICBM nose cone re-entry applications. These formulae and graphs may be found useful for making rapid engineering estimates and preliminary design evaluations of the heating problems associated with re-entry into the Earth's atmosphere. (Author)

Avco-[Everett] Research Lab., Mass.
A SHOCK TUBE INVESTIGATION OF HEAT TRANSFER IN THE WAKE OF A HEMISPHERE-CYLINDER, WITH APPLICATION TO HYPERSONIC FLIGHT, by William E. Powers, Kenneth F. Stetson, and Mac C. Adams. Rept. for Oct 56-June 57, on Contract AF 04(645)18. Aug 58, 41p. 9 refs. Research rept. 30; AD-205 513.
Order from LC mi$3.30, ph$7.80 PB 147 196

Wake heat transfer experiments, under conditions which simulate hypersonic velocities, were conducted in a constant area shock tube. The preliminary objective of establishing the utility of the shock tube for wake investigations was verified as steady state wake heat transfer rates and stable wake geometries were obtained in less than 100 μsec. The heat transfer coefficients for the wake of a sting supported hemisphere-cylinder configuration were obtained for laminar and turbulent flow on the body. Laminar heat transfer rates for the wake averaged about two-thirds

of the theoretical laminar heat transfer rate to a solid surface replacing the wake mixing line. The magnitude of the turbulent heat transfer rates was about one-third of the turbulent prediction for a solid surface replacing the wake boundary. No distinguishable variations of heat transfer rates to the sting or rear face of the model were observed for sting-to-body diameter ratios of 0.3 and 0.6, and observed variations within the wake were less than the experimental scatter of about $\pm$ 20%. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
SOME ASPECTS OF NON-EQUILIBRIUM FLOWS, by Raymond Sedney. Mar 60, 35p. 13 refs. Rept. no 1099.
Order from LC mi$3.00, ph$6.30 PB 148 238

Some of the general features of non-equilibrium flow are discussed and vibrational relaxation is discussed in detail. This case is somewhat simpler than dissociation and ionization but it illustrates some of the main new features of non-equilibrium flow. Those aspects of two-dimensional and axisymmetric flow behind shock waves are examined analytically which yield significant information without requiring numerical solution of the governing equations. The thermodynamics of a vibrational relaxing gas is discussed. The conditions for simulating flows are noted. Crocco's theorem and the characteristic equations are derived. Then a simple method of obtaining the initial gradients of the flow variables behind a shock is shown. These gradients are used in discussing two particular flows. An exact solution for flow over a cusped body is obtained. Flow over a wedge near the tip and far from the tip is considered. It is found that far from the tip a boundary layer type phenomenon occurs. (Author)

Brown U. Div. of Engineering, Providence, R. I.
STEADY-STATE HEAT CONDUCTION IN A CIRCULAR CONE, by Rokuro Muki and Eli Sternberg. Technical rept. no. 13 on Contract Nonr-562(20). Sep 59, 17p. 11 refs. Nonr 562(20)/13; AD-226 342.
Order from LC mi$2.40, ph$3.30 PB 148 584

A determination is made of the steady-state temperature distribution generated in a circular cone of infinite extent by a discontinuous distribution of the prescribed surface temperature. Specifically, the surface of the cone is exposed to a constant temperature up to a given distance from the vertex, the remainder of the boundary being maintained at a distinct uniform temperature. With the aid of the Mellin transform a solution to the foregoing problem (exact within the classical theory of heat-conduction) is deduced both in the form of an infinite residue expansion and in real integral form. The convergence of these 2 alternative representations is established and numerical results are obtained for the variation of the temperature along the axis of the cone if the opening angle is $\pi/3$. (Author)

California U., Berkeley.
DEVELOPMENT AND STRUCTURE OF PLANE DETONATION WAVES, by A. K. Oppenheim and R. A. Stern. Technical note DR 7 on Contract AF 49(638)166. Feb 60, 137p. 207 refs. AFOSR-TN-60-124; AD-233 940.
Order from LC mi$6.90, ph$21.30 PB 146 360

The current status of knowledge on the development and structure of plane detonation waves is critically reviewed. A comprehensive historical survey is reported of the problem including contemporary studies, and the exposition of: (1) current theories concerning the mechanism of the development of the process, and (2) the analysis of the structure of the steady, plane detonation wave. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
REFERENCES TO RESEARCH ON HIGH-EMISSIVITY SURFACES, by J. W. Holladay. 27 June 60, 11p. 20 refs. DMIC memo. 57.
Order from OTS $0.50 PB 161 207

In any space-vehicle heat balance solar absorptivity and emissivity are the principal factors which determine the vehicle temperature. Until recently, little work had been done on the determination of the emissivities of structural materials over a range of temperatures. In view of the new importance of emissivity information, a number of projects have been established to develop improved methods of measuring emissivity and to determine the emissivity of various materials at both high and low temperatures.

Massachusetts Inst. of Tech., Cambridge.
A FUNDAMENTAL EQUATION FOR STEAM IN TERMS OF TCHEBICHEF POLYNOMIALS, by Frank D. Skinner. Doctoral thesis. Technical rept. no. 1 on Contract Nonr-1841(60). Sep 59, 192p. 34 refs.
Order from LC mi$8.70, ph$30.00 PB 148 607

Since the appearance of the perfect-gas law over a century ago, an almost overwhelming number of equations of state have been suggested. A review of some of the more significant equations is presented with particular emphasis on Dr. F. G. Keyes' Equation VII for steam which appeared in 1949. Of the equations presented, most are simple enough to be manipulated into a fundamental form, but their accuracy is limited to fairly low pressures. Dr. Keyes' Equation VII which is accurate to very high pressures is too complex to allow a fundamental equation to be determined. Data obtained from the Keyes equation is used to determine a Tchebichef polynomial equation of a form recently suggested by C. J. Pings, Jr. and B. H. Sage of the California Institute of Technology. This equation which is accurate to very high pressures, can also be easily manipulated to form a fundamental equation for steam.

Materials Research Lab., U. of California, Berkeley
SPECIFIC HEAT OF METALS AND ALLOYS, by Ralph Hultgren. Technical note no. 4 on Contract AF 49(638)83. 1 June 60, 29p. Series no. 137, issue no. 4; AFOSR-TN-60-527.
Order from LC mi$2.70, ph$4.80 PB 148 515

Lecture given at Third Annual Conference for Sponsors, March 29, 1960; Thermophysical Properties Research Center, School of Mechanical Engineering, Purdue University, Lafayette, Indiana.

Minnesotoa U., Minneapolis.
SURVEY OF BOUNDARY LAYER HEAT TRANSFER AT HIGH VELOCITIES AND HIGH TEMPERATURES, by Ernst R. G. Eckert. Rept. on Contract AF AF 33(616)5676. Apr 60, 115p. 415 refs. WADC Technical rept. 59-624.
Order from OTS $2.50 PB 161 843

Heat transfer in boundary layer flow at high velocities and high temperatures is discussed, and engineering relations for its calculation are presented. Aeronautical and space flight applications have pushed the conditions under which heat transfer knowledge is important to much higher velocities and temperatures. The influence of very large temperature differences, of dissociation and ionization, of low densities, and of chemical reactions on heat transfer has been well established in its general features. In addition, new cooling methods, like transpiration, ablation, or film cooling have been studied. The reference enthalpy method is extended and generalized in this report to include the additional effects mentioned above. This leads to simple relations by which heat transfer can be calculated with an accuracy which should be sufficient for engineering purposes. These relations additionally have the advantage that most of them are applicable to any gas or gas mixture; therefore, not only to the reentry problem but also to heat transfer problems arising in rockets or other propulsion systems and in other applications. (Author)

Naval Ordnance Lab., White Oak, Md.
EQUATION OF STATE OF WATER, by Andre N. Gleyzal and Hans G. Snay. 9 Dec 59, 28p. 5 refs. NAVORD rept. 6749.
Order from LC mi$2.70, ph$4.80 PB 148 220

Thermodynamic quantities such as γ, S, and p as functions of temperature are calculated for temperatures sufficiently high to cause dissociation of the molecule. Thermochemical equilibrium is assumed and the Wilson-Kistiakowsky equation of state is employed. Two types of corrections for the electrostatic force, an "Unsold correction" and a "Debye-Hückel correction" are discussed but not used in the numerical calculations reported here. (Author)

Naval Ordnance Test Station, China Lake, Calif.
INVESTIGATION OF THERMAL INSULATION MATERIALS, by J. L. Abbott. 23 July 59, 50p. NOTS TP-2243; NAVORD rept. 6545; AD-225 996.
Order from LC mi$3.30, ph$7.80 PB 148 371

This investigation determined the relative heat transfer characteristics of a number of commercially available thermal insulation materials. Laboratory test methods were developed which closely simulated the results of full-scale aviation-fuel fire tests. The results from laboratory and field tests indicate that a 0.5-in. layer of commercial glass cloth can provide practicable protection of weapons and missiles against fuel fires for sufficient time to insure application of effective fire fighting techniques. The application of reflective metal foil, such as stainless steel, interlayered with the glass cloth further increases the insulation efficiency. Tests on new asbestos fiber insulation materials have shown results which indicate possible superiority to glass cloth, particularly, if they can be fabricated for interlayering with reflective foil. These materials also have the additional advantage of lower density than glass cloth. (Author)

Naval Research Lab., Washington, D. C.
TABLES OF THE EINSTEIN ENERGY, SPECIFIC HEAT AND DERIVATIVE SPECIFIC HEAT FUNCTIONS, by W. C. Overton, Jr. and J. H. Hancock. Final rept. 6 July 60, 21p. 14 refs. NRL rept. 5502.
Order from LC mi$2.70, ph$4.80 PB 146 403

The purpose of the tables given in this report is to provide numerical values of the functions $F_1(x)$, $F_2(x)$, and $F_3(x)$ in order to facilitate the calculation of thermodynamic properties of solids such as the internal energy and specific heat. The function F_1 is the Einstein quantum-theory expression for the average energy of a harmonic oscillator mode. The specific heat of a mode, F_2, is obtained from the derivative of F_1 with respect to temperature, which is proportional to $1/x$, while F_3 is the derivative of F_2 with respect to x. Using NRL's Narec electronic digital computer we have computed tables of these useful functions, F_1, F_2, and F_3, for the range $0.01 \leq x \leq 24.00$, with the interval 0.01. The values in these tables are accurate to ± 1 in the eighth significant digit and provide accuracy to ± 2 in the sixth significant digit with only linear interpolation.

New York U., N. Y.
REACTION KINETICS, THERMODYNAMICS, AND TRANSPORT PROPERTIES IN THE OZONE-OXYGEN SYSTEM, by Edwin S. Campbell and Carole Nudelman. Rept. on A Survey of Properties for Flame Studies, Contract AF 49(638)169. [1959] 122p. 69 refs. AFOSR-TN-60-502.
Order from LC mi$6.30, ph$19.80 PB 147 913

This review was undertaken to collect and evaluate the information required for a detailed theoretical analysis of the ozone flame. Although this is one of the simplest possible chemical systems, much data had to be taken from conflicting information and untested extra-polations. The thermodynamic properties are the most satisfactory of the available data. There is information on the three species of interest in this system and meaningful estimates for the accuracy of the data can be given. These data include energy, enthalpy, free energies, and heat capacities. The most important assets of this system from the standpoint of flame studies are its chemical simplicity and the possibility of varying the relative importance of the reactions by varying the concentration of ozone in the fuel gas and, therefore, the maximum flame temperature. The important transport properties for flame studies are the thermal conductivity and the diffusion coefficients. The only direct experimental information is on the thermal conductivity of oxygen at temperatures from about 80° to about 350°K.

Pennsylvania U., Philadelphia.
THE IRREVERSIBLE THERMODYNAMICS OF NON-LINEAR PROCESSES AND NOISE IN DRIVEN SYSTEMS, by William Bernard and Herbert B. Callen Technical rept. no. 13 on Contract Nonr-698(00). June 59, 140p. 15 refs. AD-217 512.
Order from LC mi$6.90, ph$21.30 PB 147 449

The theory of irreversible thermodynamics is reviewed and extended. The irreversible behavior of a system driven by externally applied forces was studied extensively, but attention was focussed primarily on the first order term in the driven response. Also considered are the higher order terms in the driven response and the random fluctuations, or noise, occurring during an irreversible process. In addition to the well known relations between the linear response and the equilibrium fluctuations, several new relations involving the non-linear response, the driven noise, and the equilibrium fluctuations are proved. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
NON-EQUILIBRIUM CENTERED RAREFACTION FOR A REACTING MIXTURE, by Luigi G. Napolitano. Rept. on Contract AF 40(600)732. June 60, 66p 5 refs. AEDC-TN-60-129.
Order from LC mi$3.90, ph$10.80 PB 148 581

General equations are derived which describe the dynamics and thermodynamics of an ideal dissociating gas when only one relaxation time, the chemical one, is different from zero. The equations are applied to the study of an expansion around a two-dimensional corner by the methods of the characteristics. The initial value problem is posed, the equations suitably transformed, and the numerical procedure, based on the usual finite difference approximation to the characteristics and regularity conditions, outlined. The expansion wave around the corner is investigated from a different viewpoint. Two series solutions are given in terms of the parameter $r = R/L$ where R is the distance from the corner and L a characteristic length which essentially depends upon both the energy involved in the reaction process and the rapidity of the reaction itself as compared to the macroscopic convective motion. (Author)

Stanford U., Calif.
HEAT CONDUCTION AND THERMAL STRESSES IN A SOLID HAVING UNEQUAL SPECIFIC HEATS, by E. W. Parkes. Rept. on Contract AF 49(638)223. Feb 60, 24p. 9 refs. SUDAER no. 90; AFOSR-TN-60-320.
Order from LC mi$2.70, ph$4.80 PB 148 506

It is usual in thermoelastic analyses to separate the heat conduction and stressing problems. This division can only be justified if the specific heat at zero stress for the material is closely equal to that at zero strain. For some materials at present under consideration for missile construction, the ratio of specific heats may depart from unity by 25%. The paper investigates the transient temperature distribution and thermal stresses in a solid subjected to one-dimensional heat flow and various kinds of stress-inducing restraints, when the specific heats are unequal. Allowance is made for the stress terms in the heat conduction equation (which are ignored when the analysis is divided) and for the variation of specific heat with temperature. It is concluded that the errors introduced by the conventional approach, although not entirely negligible, are not such as to justify the labor involved in the more correct analysis. (Author)

Stanford U., Calif.
THERMODYNAMIC FOUNDATIONS OF THE THEORY OF DEFORMATION, by J. F. Besseling. Rept. on Contract AF 49(638)223. Aug 59, 31p. 9 refs. SUDAER no. 86; AFOSR-TN-59-871.
Order from LC mi$3.00, ph$6.30 PB 148 503

It is shown that the theory of deformation can be founded on thermodynamic principles, the Galilean principle of relativity, and the concept of a natural reference state which at any instant is locally reproducible by a reversible process. The theory is a priori restricted to small inelastic strains. Explicit relations in terms of material properties are presented for small deviations from the natural reference state. Attention is drawn to the inherent nonlinearity of the thermoelastic equations in dynamic problems. (Author)

Stanford U., Calif.
THERMOELASTICITY, by E. W. Parkes. Rept. on Contract AF 49(638)223. Feb 60, 92p. SUDAER no. 91; AFOSR-TN-60-380.
Order from LC mi$5.40, ph$15.30 PB 148 507

Course of lectures on thermal and elastic constants; Maxwell's equations and the relations between the thermoelastic constants; the thermoelastic equations; boundary conditions; the heat conduction equation; elastic thermal stresses and their effects on stiffness; inelastic thermal stresses and a design philosophy for repeated thermal loading.

Theoretical Chemistry Lab., U. of Wisconsin, Madison.
THE AVAILABLE CHEMICAL ENERGY IN THE UPPER ATMOSPHERE, by Curtis A. Wagner. Rept. on Contract DA 11-022-ORD-2526. 2 May 60, 92p. 31 refs. WIS-OOR-28, Series 5; OOR rept. 1898. 10-C.
Order from LC mi$5.40, ph$15.30 PB 148 435

The total amount of available chemical energy in the atmosphere is determined for various altitudes. This is compared with approximations to the energy required to orbit a fuelless recombination ramjet missile at these same selected altitudes. Since thermodynamic, temperature, pressure, and especially composition data are extremely critical to these calculations, a discussion of sources is included. Details of the thermodynamic calculations and the computational techniques employed in conjunction with the Bendix G-15 high speed computer are also discussed. Tables of important data and results are presented

for future reference and checking; new temperature, pressure, and composition data will undoubtedly be available soon for more accurate calculations. These calculations, using presently available data, indicate that operation of such a vehicle would be marginal around 120 kilometers and impractical elsewhere. (Author)

Wave Propagation

Center for Radiophysica and Space Research, Cornell U., Ithaca, N. Y.
SCATTERING OF RADIO WAVES BY ELECTRONS ABOVE THE IONOSPHERE, by E. E. Salpeter. Arecibo Radio Observatory scientific rept. no. 3 on Contract AF 19(604)6158. 18 Apr 60, 6p. 4 refs. Research rept. RS-8; AFCRC-TN-60-397.
Order from LC mi$1.80, ph$1.80 PB 148 523

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
TROPOSPHERIC SCATTER PROPAGATION INVESTIGATION, by Wilfred K. Klemperer. Final rept. on Contract AF 19(604)1835. 19 Feb 60, 74p. 29 refs. Rept. no. C-1074-P-1; AFCRC-TR-60-132.
Order from LC mi$4.50, ph$12.30 PB 147 909

A receiving station of a 395 mile scatter link operating at 915 mc was established and operated for three years. Probability amplitude distribution and power spectra were obtained for the received signal and analyzed to determine the degree to which the data verified existing theories on tropospheric scatter propagation. Some evidence exists which indicates that amplitude distribution of the received signal is distributed in accordance with Rayleigh statistics for periods up to about 100 seconds. Investigation of the relationship of characteristics of the received signal with meteorological phenomena shows that a correlation exists between the fading range and wind shear in the scatter volume. No correlation was observed between the signal characteristics and the height of the tropopause. Peaks in the received signal due to forward scattering by lightning discharges were identified.

Electrical Engineering Research Lab., U. of Texas, Austin.
A CRITICAL ANALYSIS OF FIELD STRENGTH MEASUREMENTS AT FREQUENCIES ABOVE 30 MCPS, by A. H. LaGrone and Tadao Inami (Doctoral thesis). Rept. on Contract AF 19(604)5504. 3 June 60, 213p. 193 refs. Rept. no. 6-35; AFCRC-TN-60-557
Order from LC mi$9.60, ph$33.30 PB 148 209

Although the study of propagation of radio waves with frequencies above 30 mcps began in relatively recent years, numerous field-strength measurement data are now available. In this paper, the authors have analyzed, compared, and criticized these data. Problems concerning the propagation of radio waves at frequencies above 30 mcps are considered for the optical and diffraction regions, and for scattering in both the troposphere and ionosphere. Original and comprehensive mass plots of signal strength are made to more effectively present the information. Absorption due to oxygen and water vapor molecules in the atmosphere and attenuation caused by scattering due to water drops are also treated. (Author)

Electrical Engineering Research Lab., U. of Texas, Austin.
RAINFALL ATTENUATION OF 2.15 mm RADIO WAVELENGTHS, by C. W. Tolbert, J. R. Gerhardt, and W. W. Bahn. Rept. on Contract Nonr-375(01). 14 June 59, 20p. 4 refs. Rept. no. 109.
Order from LC mi$2.40, ph$3.30 PB 147 394

The attenuation of 2.15 millimeter radio frequency energy by rainfall has been measured and found to be in fair agreement with the attenuation calculated from the precipitation rates. Some discrepancy between the measured and calculated attenuations is due to the inhomogeneity of the rainfall along the propagation path and to the spectra of drop sizes associated with the various precipitation rates. (Author)

Electrical Engineering Research Lab., U. of Texas, Austin.
WAVE PROPAGATION THROUGH A TURBULENT TROPOSPHERIC LAYER, by H. D. Wade and B. M. Fannin. Rept. on Contract AF 19(604)5504. 30 May 60, 66p. 27 refs. Rept. no. 6-34; AFCRC-TN-60-556.
Order from LC mi$3.90, ph$10.80 PB 148 208

The analysis of wave propagation phenomena induced by homogeneous tropospheric layers is adequately accomplished through the use of conventional wave theory (microwave optics). Propagation through homogeneous tropospheric turbulence can be handled theoretically by the use of a first Born approximation (single scattering) approach in many cases. The choice of the proper theory to apply to the case of propagation through a tropospheric layer of anisotropic turbulence is not clearly established. This report presents a preliminary analysis of wave propagation through such a layer. A comparison is made of single scattering and wave theory analyses of wave propagation through a homogeneous non-turbulent tropospheric layer in order to gain insight into the validity of single scatter theory for a limiting case. The single scattering approach is then applied to an assumed mathematical model of an anisotropically turbulent tropospheric layer, and integral expressions are derived for the cross-correlation functions of the amplitude and phase, respectively, of a wave which has passed through the layer.

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
BIBLIOGRAPHY ON ELECTROMAGNETIC WAVE PROPAGATION, by Arnold Matschke. Rept. on Contract DA 36-039-sc-78281. 1 Apr 59, 79p. 870 refs. EDL-M186; AD-216 404.
Order from LC mi$4.50, ph$12.30 PB 148 046

The purpose of this bibliography is to provide an up-to-date (1947-1958) reference to publications from laboratories foremost in their respective fields of upper atmospheric research, wave propagation, and wave scattering phenomena. The laboratories whose work in these fields has comprised the basis for this

report are: Cavendish Laboratory, University of Cambridge; Electrical Engineering Department, Cornell University; Ionospheric Research Laboratory, the Pennsylvania State University; Radio Propagation Laboratory, Stanford University; Stanford Research Institute. (Author)

Electronics Research Lab., U. of California, Berkeley.
ANALYSIS OF THE IMAGE PLANE METHOD FOR MEASURING RADAR CROSS-SECTIONS, by Andrejs Olte. Rept. on Contract N7onr-29529. 2 Sep 59, 54p. 11 refs. Rept. no. 92; Series no. 60, issue no. 249; AD-230 400.
Order from LC mi$3.60, ph$9.30 PB 148 619

Investigation concerns the development of a technique to measure scattered field patterns and scattering cross sections with a high degree of precision and accuracy. Emphasis is on extension of the image plane technique previously developed. The discussion covers a description of the measuring system in use and some order of magnitude calculations, an analysis of the system, and the range and accuracy of the CW image plane technique. The following equivalent techniques are compared and discussed: the Doppler technique, the pulse technique, the continuous wave full space technique, and the continuous wave image plane technique.

Electronics Research Lab., U. of California, Berkeley.
BACK-SCATTERING FROM CONES, by G. August and D. J. Angelakos. Rept. on Contract N7onr-29529. 22 Sep 59, 25p. 8 refs. Rept. no. 95; Series no. 60; issue no. 252; AD-230 508.
Order from LC mi$2.70, ph$4.80 PB 148 621

The purpose of this experimental investigation was to determine the back-scatter cross sections of a family of right-circular metallic cones with a greater accuracy than measured in a previous investigation. Three cones in the resonance region were examined, using the image plane method of measurement. Back-scatter was measured at about 9328 mc. as a function of the aspect angle between the incident radiation propagation direction and the cone axis. The cones and a comparison sphere were halves of volumes of revolution, thus allowing use of the image technique. A 4.5" diameter metallic sphere was used as a reference target. The theory of scattering from a metallic sphere is well-known, and its absolute back-scatter cross section may be calculated. Consequently, the absolute back-scatter cross sections of the cones may be computed by comparison of the data of this report with the absolute cross-section of the reference sphere. By use of a suitable measurement procedure, it was possible to largely eliminate a characteristic error of the image plane technique. The accuracy of the measurements was improved by an averaging process, and the measurements themselves gave an estimate of the error in the data. (Author)

Electronics Research Lab., U. of California, Berkeley.
SOME NEW FORMS OF HUYGENS' PRINCIPLE, by V. H. Rumsey. Rept. on Contract N7onr-29529. 18 Sep 59, 43p. 19 refs. Rept. no. 93; Series no. 60, issue no. 250; AD-230 483.
Order from LC mi$3.30, ph$7.80 PB 148 620

Several theorems are derived by using the reaction concept. They apply to single frequency sources of finite extent, and to fields which are finite and continuous on a hypothetical closed surface S whose inside or outside is source free. The field on the source-free side of S is uniquely determined by the normal components E_n and H_n on S. For measurements on the source-free side of S, the primary source can be replaced by any of the following secondary sources on S: (a) normal electric and magnetic dipoles in free space; (b) normal electric and magnetic quadrupoles backed by a medium which makes $E_n = 0$ and $H_n = 0$; and (c) a certain combination of electric and magnetic normal dipoles and quadrupoles, which gives zero field on the source side of S. The prescription for (a) requires the solution for the field of the primary source when it is inside a cavity on whose walls $E_n = 0$ and $H_n = 0$. The surface densities of the various components of secondary sources (b) and (c) are given in terms of the free space primary field. The formulas are comparatively simple when S is plane. Many applications are cited including a combination of multipoles, consisting of vertical electric and magnetic dipoles, which is equivalent to a horizontal electric dipole. (Author)

Florida U., Engineering and Industrial Experiment Station, Gainesville.
UHF PROPAGATION STUDY, VOL. I, by M. H. Latour. Final rept. on Contract Nonr-580(04). Sep 59, 75p. 10 refs. AD-228 623.
Order from LC mi$4.50, ph$12.30 PB 148 589

Results of a UHF experimental trans-horizon propagation study are presented. The propagation path of 300 miles was entirely over sea. Received pulse signals at 1260 mc were sorted into 30 levels approximately one db apart and amplitude distribution recorded in real time. Summer time signals were found to be generally higher than those received during the Winter. Any diurnal variations were masked by other factors which produced greater signal variations. The signal level appeared to be related to the absolute value of the surface refractive index of the atmosphere. Refractometer data indicated greater fluctuations of atmospheric refractivity with height during the summer months. The short term variation of the signal appeared to be Rayleigh distributed except during periods of super-refraction. The fluctuation rate varies inversely with signal amplitude, with higher rates associated with low signal periods. Evidence of multipath propagation was observed frequently. Many cases of extreme delays were obviously caused by the ionized paths of lightning discharges. Other cases are suspected of being caused by foreward scatter from rain. (Author)

Göttingen U. (West Germany).
ABSORPTION AND TRANSMISSION OF ELECTROMAGNETIC WAVES. PHASE G: EFFECTIVENESS OF ABSORBERS FOR ELECTROMAGNETIC CM-WAVES UNDER OBLIQUE ANGLES OF INCIDENCE, by G. Kurtze. Technical final rept. on Contract AF 61(514)1041. 31 July 58, 28p. 5 refs. RADC-TR-59-26C; AD-210 939.
Order from LC mi$2.70, ph$4.80 PB 146 709

In the development of absorbers for electromagnetic cm-waves main emphasis has mostly been laid on getting minimum reflection for normally incident waves. For laboratory use and also for RADAR camouflage under certain conditions, however, also the specular reflection of absorbers under oblique angles of incidence should be small. For absorbers with layer thicknesses of about one wavelength or larger this demand will mostly be fulfilled. The present study has been started in order to find out how resonance type absorbers with layer thicknesses small in comparison with the wavelength behave in this respect, and how the angular response of their reflection factor can be improved. It is the first step towards the development of wide angle resonance absorbers.

Institute of Mathematical Sciences, New York U., N. Y.
MULTIPLE DIFFRACTION BY AN APERTURE IN A HARD SCREEN, by Samuel N, Karp and Joseph B. Keller. Rept. on Contract AF 19(604)5238. Nov 59, 22p. 8 refs. Research rept. EM-143; AFCRC-TN-59-995; AD-233 253.
Order from LC mi$2.70, ph$4.80 PB 147 344

Two methods previously applied to diffraction by an aperture in a soft screen (one on which the field vanishes) are adapted to the case of a hard screen (one on which the normal derivative of the field vanishes). These methods are the geometrical theory of diffraction and the self consistent field method. They are both applied to diffraction by an infinite slit and both yield the same result at distances greater than several wave lengths from the edges of the screen. The former is also applied to diffraction by a circular aperture. Expressions for the diffracted fields, the diffraction patterns and the transmission cross sections are obtained for the problems of the slit and the circular aperture. (Author)

Ionosphere Research Lab., Pennsylvania State U., University Park.
RADIO PROPAGATION AND IONIZED GASES. A SURVEY, by H. D. Rix. Scientific rept. no. 123, part A on Ionospheric Research, Contract DA 36-061-ORD-577. 1 Sep 59, 53p. 49 refs. AD-233 394.
Order from LC mi$3.60, ph$9.30 PB 147 248

This report surveys electromagnetic wave propagation effects relating to the problem of radio interference encountered during powered flight of large missiles. An expression for the absorption of a radio signal traversing a plasma is developed from the approximate theory of plasma conductivity. Properties of several types of plasma - flames, gaseous discharges and shock waves - are described in terms of methods of measuring electron density, mechanisms of ionization and means of controlling free electron concentration. Specific propagation effects treated include high frequency antenna breakdown and ionospheric effects. A guide to the relevant literature of these various subjects is provided. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
DIFFRACTION BY AN ABSORBING HALF-PLANE, by C. J. Marcinkowski. Rept. on Contract AF 19(604)4143. 29 Sep 59, 93p. 36 refs. Research rept. R-750-59; PIB-678; AFCRC-TN-60-153; AD-234 015.
Order from LC mi$5.40, ph$15.30 PB 146 321

The 2-dimensional electromagnetic problem of plane-wave scattering by a half-plane with a constant impedance is solved by the Wiener-Hopf technique. Previous solutions have dealt with small surface impedance and were formulated by the classical Fourier transform procedure. In contrast, results of this study are applied to the (no longer small) surface impedance of a half-plane which absorbs perfectly a plane wave incident at a prescribed angle. Moreover, a transmission line formulation of the problem is employed. A saddle point evaluation of the scattered far-fields shows that the back-scattered fields are appreciably influenced by the surface impedance while the forward-scattered fields are relatively unaffected. A null appears in the back-scattered fields. Another variant of the factorization technique for dielectric surfaces was discovered and illustrated by obtaining the well-known solutions for a perfectly reflecting half-plane. (Author)

Raytheon Co., Waltham, Mass.
IONOSPHERE PROPAGATION STUDIES, by Leonard C. Edwards, and Donald A. Hedlund. Final scientific rept., Pt. 1, 15 June 57-15 Sep 59, on Contract AF 19(604)2246. 15 Oct 59, 38p. 7 refs. AFCRC-TR-60-104(1); AD-233 734.
Order from LC mi$3.00, ph$6.30 PB 146 813

An experimental investigation of some characteristics of ionospheric forward scattering was conducted in the HF band. The nature of the scattering process was investigated, and an indication of the usefulness of this mode of propagation was provided at frequencies ordinarily employed for communication only when normal ionospheric modes prevail. An experimental HF radio link was established between Greencastle, Indiana and South Dartmouth, Massachusetts. Measurements were made over a 3-yr period to describe the diurnal and seasonal variations in the scatter signal level. Special attention was given to describing the variations in signal level which occur when operating very near the classical MUF for the path. Several experiments were also conducted to investigate the area extent and possible movement of ionospheric regions which contribute to the received scatter signal. Experiments of this type emphasized the effectiveness which can be obtained for any given antenna applied to an ionospheric scatter path. A search was made in the data regularly recorded, and in data obtained in several special experiments, to determine if sufficient ionization is associated with earth satellites to be detected using HF techniques. (Author)
(See also PB 144 379)

Stanford Electronics Lab., Stanford U., Calif.
A NEW MECHANISM FOR ACCELERATING ELECTRONS IN THE OUTER IONOSPHERE, by R. A. Helliwell and T. F. Bell. Technical rept. no. 4 on Contract AF 18(603)126. 23 Feb 60, 10p. 7 refs. AFOSR-TN-60-151; AD-234 472.
Order from LC mi$1.80, ph$1.80 PB 147 336

The phenomena of high energy trapped particles are studied in the earth's outer ionosphere using a new device for particle acceleration, the geocyclotron. Through this device, trapped electrons in the outer ionosphere can be accelerated to high energy utilizing circularly polarized radiation, traveling in the whistler-mode, and the inherent phase stability of the particle-wave interaction. It is shown that this interaction is roughly analogous to the well-known synchrotron interaction. Implications of the theory are discussed and experiments are suggested which might lead to important new information concerning the behavior of particles trapped in the earth's magnetic field. (Author)

Stanford Electronics Labs., Stanford U., Calif.
A THEORY OF TRAPPING OF WHISTLERS IN FIELD-ALIGNED COLUMNS OF ENHANCED IONIZATION, by R. L. Smith, R. A. Helliwell, and I. W. Yabroff. Technical rept. no. 3 on Contract AF 18(603)126. 31 Dec 59, 22p. 15 refs. AFOSR-TN-60-139; AD-233 813.
Order from LC mi$2.70, ph$4.80 PB 146 359

A ray theory of whistler propagation in ducts is developed for the purpose of explaining discrete whistler components. By use of refractive index surfaces and a Snell's Law construction, it is shown that the only feature of the electron distribution affecting the trapping conditions is the ratio of the electron density in the column to that of the background. In most practical cases the electron density in the column required for trapping must be greater than the background level. However, under certain conditions the density in the column must be less than the background level. Using the theory, it is found that the enhancement required for trapping increases markedly toward the equator, providing a possible explanation for reduced whistler occurrence at the lower latitudes. (Author)

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Avco-[Everett] Research Lab., Mass.
DEVELOPMENT OF THE CALORIMETER HEAT TRANSFER GAGE FOR USE IN SHOCK TUBES, by Peter H. Rose. Rept. on Contract AF 04(645)18. Feb 58, 52p. 13 refs. Research rept. 17; AD-159 547.
Order from LC mi$3.60, ph$9.30 PB 147 396

A heat transfer gage suitable for measuring extremely high heat transfer rates under the quasi-transient conditions occurring in shock tubes has been developed. The instrument is based on a colorimetric principle and is made possible by the short steady state times inherent in shock tubes. The technique developed supplements, verifies and extends the shock tube heat transfer measurements made by thin film resistance thermometers. Much heat transfer data has already been collected by this type of instrument and has been reported. The operating principles and experimental experiments with calorimeter heat transfer gages are reported in some detail. (Author)

California U., Los Angeles.
ON THE THEORY OF ADAPTIVE CONTROL SYSTEMS, THE LEARNING MODEL APPROACH, by M. Margolis and C. T. Leondes. Rept. on Contract AF 49(638)438. Oct 59, 29p. 4 refs. AFOSR-TN-59-1200; AD-233 275.
Order from LC mi$2.70, ph$4.80 PB 146 736

The main objective of feedback control is to maintain satisfactory performance despite adverse environmental effects. A process adaptive system is one which determines the values of the significant parameters in the physical process and used these values to program the controller according to the specified controll laws. The use of a process adaptive system makes it possible to design the complete control system for a specified requirement without compromising the setting of the controller parameters for the range of dynamic characteristic variation. The learning model will determine these variations and present the exact values to the proper computing circuits for adjusting the parameters in the controller. The particular method for determining the dynamic characteristics of the physical process makes use of a model, referred to as the learning model, and a mechanism to adjust the parameters of the model. The model is a computer mechanization of the physical process with undetermined parameters. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
INVESTIGATION OF HIGH TEMPERATURE RESISTANT MATERIALS, by C. R. Mason, J. D. Walton and others. Quarterly rept. no. 14, 1 Feb-30 Apr 59, on Contract NOrd-15701. [1959] 30p.
Order from LC mi$2.70, ph$4.80 PB 148 059

Thermal Protection Systems: The thermal diffusivity-temperature relationship was determined by considering K and Cp separately and calculating the diffusivity at specified temperatures. The thermal conductivity of slip-cast fused silica (density 117 lb/cu ft) was found to vary linearly with temperature over a range from 420° to 1350°F with values of 0.36 and 0.42 (Btu)-(ft)/(hr)(sq ft)(°F) respectively. Coatings: A technique for forming thin shapes by flame spraying onto a removable brass pattern was developed. Thermets: Certain physical properties of beryllium-chromic oxide thermets were determined using either beryllia or chromium as the reaction throttler. (See also PB 142 326)

Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS. Quarterly rept. for July-Sep 59. Jan 60, 130p. 53 refs. NOLC rept. 473; NAVORD rept. 5970; AD-234 258.
Order from LC mi$6.30, ph$19.80 PB 147 247

Contents:
Automatic programming
Ferroelectric phenomena
Ferromagnetic resonance
High-temperature polymer program
Infrared atomic spectra
Magnetization reversal studies
Radiation analysis
Semiconductor physics
Small antenna study
(See also PB 144 558)

Naval Ordnance Test Station, China Lake, Calif.
SOME GYROSCOPIC OSCILLATIONS. PART 1. GENERAL CONSIDERATIONS, by C. J. Thorne. 25 May 59, 84p. 2 refs. NOTS TP 2240; NAVORD rept. 6542, pt. 1.
Order from LC mi$4.80, ph$13.80 PB 148 101

Consideration is given to nonlinear terms in the differential equations governing the motion of gyroscopes under constant acceleration and a "correcting" torque. Unstable oscillations are noted when a "correcting" torque is present and the nonlinear terms are included. (Author)

Virginia Agricultural Experiment Station, Blacksburg.
SOME FURTHER RESULTS ON THE LIFE DISTRIBUTION AND RELIABILITY OF A SYSTEM WITH SPARE COMPONENTS, by Donald F. Morrison. Technical rept. no. 46 on Research on Order Statistics and the Design of Experiments, Contract DA 36-034-ORD-1527. Apr 60, 64p. 18 refs. OOR rept. 1166.52-M.
Order from LC mi$3.90, ph$10.80 PB 148 441

Contents:
The distribution of component failures on an interval of time
Cost functions for measuring the efficacy of spare components
Systems with several types of components

Communication Theory

Air Force Cambridge Research Center, Bedford, Mass.
PROCEEDINGS OF SEMINAR ON SPEECH COMPRESSION PROCESSING, 28-30 SEPTEMBER, 1959, VOLUME II. Dec 59, 211p. 62 refs. AFCRC-TR-59-198, vol. 2.
Order from LC mi$9.60, ph$33.30 PB 146 624

Contents:
The speech research program of the Air Force Cambridge Research Center
An approach to speech bandwidth compression
A digital voice data processer
Study of correlation instrumentation for speech analysis and synthesis
The magnetic drum as a component in speech compression and processing equipment
Speech research at the Royal Institute of Technology, Stockholm
The speech program at Wright Air Development Center
The Army and speech processing
Parametric recognition of phonetic sounds
Linguistic concepts in automatic speech recognition procedures
Research on speech recognition at Lincoln Laboratory
Electronic cognition of speech
Some problems in speech recognition
Investigation procedures for speech recognition
Analysis by synthesis
A round table résumé of speech research in Europe
(See also PB 146 623)

Air Force Cambridge Research Center, Bedford, Mass.
PROCEEDINGS OF SEMINAR ON SPEECH COMPRESSION AND PROCESSING, 28-30 SEPTEMBER 1959, VOLUME I. Dec 59, 208p. 55 refs. AFCRC-TR-59-198, vol. 1; AD-233 717.
Order from LC mi$9.30, ph$31.80 PB 146 623

Contents:
Basic factors in speech perception and applications to speech processing
Effects of multiple narrow pass band filtering on the intelligibility of speech
Some aspects of intonation and stress
The effective use of digital simulation for speech processing
Experiments with a dynamic analog of the vocal tract
Automatic resolution of speech spectra into elemental spectra
Some progress with vocoder-type systems
Characteristics of modern vocoders and remaining problems
Vocoders for military use
A twelve-channel transistorized vocoder
Simulation of a vocoder
The SRDE speech bandwidth compression project
The Formoder as a tool for speech studies
A digitalized continuous-analysis speech compression system
A review of Stromberg-Carlson research programs in Formant tracking and word recognition

International Telemeter Corp., Los Angeles, Calif.
FINAL REPORT. Rept. [on Contract AF 30(602)1566] 15 Nov 57, 10p. RADC-TR-58-4; AD-148 548.
Order from LC mi$1.80, ph$1.80 PB 146 724

The ultimate objective of this work is the construction of a billion-bit memory with 10 millisecond access time. The immediate objective, which was accomplished, was the construction of one module - with a single reading head - of a capacity of 30 million bits and random access of 50 milliseconds. In order to obtain results on its performance, it was considered important to build the memory as part of a useful system. A Mechanical Translator was chosen because there is a definite military requirement for MT, a minimum amount of input-output is necessary and the contents of the store are already

well organized (in dictionaries). The objective of the Mechanical Translation system is to provide an automatic means of working satisfactory translations of Russian technical material, in large volume without the need of pre-or-post-editing. This report then covers the work done in building a photostore as the heart of a Mechanical Translation system. It also includes the preparation of the contents and loading the memory with the information.

Photographic Equipment

International Telemeter Corp., Los Angeles, Calif.
FILM-TO-DISC TRANSFER UNIT OPERATION MANUAL. Technical rept. no. 16 [on Contract AF 30(602)1566] 20 Oct 57, 12p. RADC-TN-57-387; AD-131 383.
Order from LC mi$2.40, ph$3.30 PB 146 726

International Telemeter Corp., Los Angeles, Calif.
TAPE-TO-FILM TRANSFER UNIT OPERATION MANUAL. Technical rept. no. 14 [on Contract AF 30(602)1566] 20 Oct 57, 27p. RADC-TN-57-385; AD-131 381
Order from LC mi$2.70, ph$4.80 PB 146 725

This manual has been prepared in such a manner as to enable the operator to understand basically, the working of the machine. While this is not entirely essential, it is the best way to avoid unnecessary errors. The making of a film from paper tape is fundamentally a simple process, but as a great many operations are required, and many of them being repetitive, great care is needed if a perfect film is to be the result. In the construction of the machine, every effort has been made to eliminate possible operator errors. This has been accomplished by the use of a complicated system of interlocks. Even the most thoughtful interlock system will be of no avail if the operator is unaware of their presence. It is for this reason that every part of the operation manual must be understood and studied closely before commencing to operate the machine.

SOCIAL SCIENCES

California U., Los Angeles.
AN EMPIRICAL STUDY OF ARRIVAL, SERVICE TIME, AND WAITING TIME DISTRIBUTIONS OF A JOB SHOP PRODUCTION PROCESS, by Ross T. Nelson. Rept. on Management Sciences Research Proj. Contract [Nonr-233(02)]. 19 June 59, 41p. 13 refs. Research rept. no. 60.
Order from LC mi$3.30, ph$7.80 PB 146 682

There were two principle purposes for this empirical study: To collect arrival and service time data in a typical job shop and analyze the data with respect to the basic questions of time stability and distribution forms. To evaluate waiting line theoretical models as potential aids in job shop production control systems on the basis of empirical data. Time stability tests were applied to both the arrival and service time data. The hyper-Erlang model, proposed on the basis of the service time analysis of Section 2, is described more precisely in Section 3 by the equations of detailed balance, the secular equation, and a discussion of the computational requirements. It is concluded that, while this model might provide more accurate results in many cases, numerical computation would probably require a computer program.

Harpur Coll., State U. of New York [Endicott, N. Y.]
OFFSHORE CLAIMS IN NORTHWESTERN EUROPE, by Lewis M. Alexander. Technical rept. no. 1 on Contract Nonr-1349(03). Sep 59, 53p. 58 refs. AD-226 983.
Order from LC mi$3.60, ph$9.30 PB 148 580

The problems of national claims to offshore areas have in recent years become a major topic of international concern. In the conflict between offshore rights and the freedom of the seas the states of Northwestern Europe have stood out as leaders in the formulation of national and international policy. The nature and extent of the offshore claims of these states are summarized. (Author)

Brown U., Providence, R. I.
PRICE EQUILIBRIUM AND THE "GREATEST GOOD FOR THE GREATEST NUMBER", by David Gale. Technical rept. no. 3 on Contract Nonr-562(15). 1959, 20p. 4 refs.
Order from LC mi$2.40, ph$3.30 PB 146 411

The present note was prompted by the observation that the idea of equilibrium prices plays a central role in many other economic situations besides that of price formation for an economy as a whole. Our concern here will be with situations in which it makes sense to assume that each individual in the economy places a definite monetary value on the various objects of goods bundles under consideration.

Documentation

Directorate of Engineering Standards, Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
MICROFILM APERTURE CARD SYSTEM, by Thomas H. Korte, Thomas C. Myers, and John W. Berry. [1959] 160p. WADC Technical rept. 59-746; AD-232 960.
Order from OTS $3.00 PB 161 871

The microfilm aperture card system, which is a new concept in the storage, reproduction, and distribution of engineering drawings, and associated data is discussed. The microfilm aperture card is a common, ordinary tabulating punch card. A rectangular hole or aperture is die-cut into this card. The hole is edged with a narrow, transparent adhesive ledge. To this adhesive ledge is affixed a segment, or frame, of microfilm containing a transparency of an engineering drawing. Factual information to the drawing is punched into the card and automatically printed along the top edge. The new system will operate as follows: instead of furnishing full-size vandykes of drawings

by contract, the aircraft and supporting industries of the US will furnish microfilm and punched tabulating cards to the central AF automation control. From these, master microfilm aperture cards will be generated for the AF central drawing repository. The new method combines the advantages of microfilm with the operational precision and speed of automatic tabulating equipment. The system overcomes the problems of excess storage space and shipping-weight as well as the problems of high-cost and low-output-rate formerly associated with comprehensive handling of engineering drawings.

Herner and Co., Washington, D. C.
THE RELATIONSHIP OF INFORMATION-USE STUDIES AND THE DESIGN OF INFORMATION STORAGE AND RETRIEVAL SYSTEMS, by Saul Herner. Technical note no. 1 on Contract AF 30(602)1857. 8 Dec 58, 30p. 20 refs. RADC-TN-59-136; AD-213 781.
Order from LC mi$2.70, ph$4.80 PB 147 028

A review is presented of the results of past studies of the information-gathering methods of workers in various fields, and the general applicability of these results to the design and improvement of information programs and systems is shown. Two cases from the literature are used to illustrate storage and retrieval systems that do and do not meet the requirements of their users, and to show the contrasting need of the pure scientist for mere references to information and of the applied scientist for direct access to actual information. The applied scientist is shown to require the services of large storage and retrieval programs manned by highly trained personnel, while the pure scientist is best served by a conventional library in which the publications are arranged on the basis of a classification scheme reflective of the scientist's customary association of subjects. Low redundancy in manual and machine systems is cited as a means of improving input and output. Differences in the required information coverage of systems serving pure scientists, applied scientists, and social scientists and humanists are indicated, with the pure scientist requiring a narrow collection going back comparatively far in time, the applied scientist requiring a broad but shallow coverage, and the social scientist requiring both depth and breadth. Investigations of the various media used by user groups to communicate and obtain different kinds of information are advanced as a further means of knowing what should and should not be put into a storage and retrieval system. (Author)

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS, Aug 60.
Order from OTS $1.25, $10.00/year PB 161 284

Contents:
Articles:
A fision-product detector for water-cooled reactors, by C. M. Gordon, J. H. Miller, and R. E. Larson
Basic hydrogen-producing processes in electrolytic cells. III--Influence of the electronic configuration of palladium alloys on their catalytic activity, by S. Schuldiner
Precision frequency standards and millisecond timing, by H. F. Hastings
Scientific program:
Astronomy and Astrophysics: Fission product radioactivity in the air along the 80th meridian (west) during 1959
Chemistry: Properties of paints as affected by ultraviolet radiation in a vacuum. Microbial inhibitors for systems of jet fuel and water. Homogeneous ionic polymerization of alpha-methylstyrene
Mechanics: Dynamic design-analysis method for calculating the shock response of Navy shipboard equipment
Metallurgy and Ceramics: Exploratory titanium alloy research. Crack propagation tests of air-melted and consutrode AMS 6434 steel. Oil-ash corrosion in marine boilers. New technique and apparatus for high-temperature measurements of strain in sheet metal specimens. Preliminary study of the mechanisms of oxidation of iron-chromium binary alloys in water vapor
Nuclear and Atomic Physics: New method for the analysis of lithium hydride uses on-the-shelf equipment, permits careful handling of specimen, and protects against unwanted side reactions
Optics: Typical absolute spectral irradiance curves of upwelling of light over an area of the North Atlantic Ocean
Radio: Impedance-matching network for a two-band, "discage" antenna. Data transmission facility for the NRL space surveillance system. Luminance required of opaque and transparent crt phosphors. Spiral-grating antenna array without doublets eliminates problem of spacing between elements
Solid-State Physics: Modification in growing technique imporves optical quality of single crystals of ZnF_2:Mn. Elevated temperature diffusion of the systems Nb-Pt, Nb-Se, Nb-Zn, Nb-Co, Ni-Ta, and Fe-Mo. Effect of O_2 on the magnetoresistance of Cu
Sound: Mutual mechanical radiation resistance for all values of ka of an unbaffled circular rigid piston with pressure-released back. Use of spheroidal wave functions in the empirical description of scalar wave fields.
Published Reports
Papers by NRL Staff Members

ATOMIC ENERGY COMMISSION REPORTS

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General

Blast and shock measurements. III Transient ground displacement measurement, by W. E. Morris. Naval Ordnance Lab., White Oak, Md. [1952]. Decl. Sep 59. 249p. Order from LC. Mi $11.10, ph $37.80. WT-368

Biology and Medicine

Preliminary studies of scavenging systems related to radioactive fallout, by John Stockham and others. Illinois Inst. of Tech., Research Foundation. Dec 59. 8p. Contract AT(11-1)-626. Order from LC. Mi $1.80, ph $1.80. ARF-3127-10

Chemistry—General

Kinetics of reactions between two liquid phases, by L. H. Fister, and others. [Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy]. 1955. 24p. Contract AT(30-1)-1985. Order from LC. Mi $2.70, ph $4.80. AECU-4570

Organic coolants and moderators for nuclear reactors, by E. U. Kauer. Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C. Dec 59. 10p. Order from LC. Mi $1.80, ph $1.80. AECU-4590

Progress report on development of radioisotope tracer techniques for studying decomposition of complex organic wastes, by R. E. McKinney. Massachusetts Inst. of Tech., Cambridge. Feb 59 to Jan 60. 8p. Contract AT(30-1) 2329. Order from LC. MI $1.80, ph $1.80. AECU-4712

Progress report No. XXVI, Massachusetts Inst. of Tech., Cambridge Lab. for Insulation Research. Jan 60. 73p. Contract Nonr-1841(10); Nonr-1841(50); AT(30-1)-1937; AF19(604)-5482; and AF32(616)-5920. Order from LC. Mi $4.50, ph $12.30. AECU-4715

Electrochemical studies of hafnium, zirconium and yttrium, Bureau of Mines. Boulder City Metallurgy Research Lab., Nev. and Bureau of Mines. Reno Metallurgical Research Center, Nev. Oct 50 to Dec 59. 6p. Contract AT(11-1)-475. Order from LC. Mi $1.80, ph $1.80. AECU-4726

The vaporization, thermodynamics, and phase behavior of uranium monosulfide, by E. D. Cater. Argonne National Laboratory, Argonne, Illinois. Mar 60. 178p. Contract W-31-109-eng-38. Order from OTS. Price $3.00. ANL-6140

Kinetics of particle growth in a fluidized calciner, by B. S. Lee. Argonne National Laboratory, Argonne, Illinois. June 60. 125p. Contract W-31-109-eng-38. Order from OTS. Price $2.50. ANL-6171

Absorption spectra in fused salts, by H. M. Haendler. Brookhaven National Laboratory, Upton, N. Y. Jan 60. 13p. Contract No. AT-30-2-GEN-16, Subcontract No. S-284. Order from OTS. Price 50. BNL 599 (T-172)

Comparison of two colorimetric methods for uranium, by R. L. McCutchen. Oak Ridge National Lab., Tenn. Mar 59. 10p. Order from LC. Mi $1.80, ph $1.80. CF-59-3-108

Apparent copper rate constants determined in in-pile loop experiment L-2-22, by G. H. Jenks and others. Oak Ridge National Lab., Tenn. Mar 60. 13p. Order from LC. Mi $2.40, ph $3.30. CF-60-3-88

The preparation of uranium dioxide from a molten salt solution of uranyl chloride, by W. L. Lyon, and others. Hanford Atomic Products Operation, Richland, Washington. Oct 59. 20p. Order from OTS. 75 cents. HW-62431

Studies of hydrogen sorption on Pal palladium and the separation of hydrogen from gas mixtures, by R. H. Boice, and others. Knolls Atomic Power Lab., Schenectady, N. Y. Feb 52. 74p. Contract W-31-109-eng-52. Order from LC. Mi $3.60, ph $9.30. KAPL-660

Counting techniques in the radio-chemical determination of U-235 fission burn-up, by D. G. Miller. Knolls Atomic Power Lab., Schenectady, N. Y. Mar 60. 29p. Contract W-31-109-eng-52. Mi $3.00, ph $6.30. KAPL-M-DGM-5

Free energy functions for gaseous monoxides, by L. Brewer and others. Lawrence Radiation Lab., Berkeley, Calif. June 60. 17p. Contract No. W-7405-eng-48. Order from OTS. 50 cents. UCRL-8713(Rev.)

An investigation of a "dynamic" theory for mass transfer, by R. B. Schappel. Union carbide nuclear company, Division of union carbide corp., Oak Ridge, Tennessee. May 60. 115p. Contract No. W-7405-eng-26. Order from OTS. $2.75. Y-1298

Geology and Mineralogy

Exploratory diamond drilling in the No Name Canyon area, White Canyon Dristrict, San Juan County, Utah, by E. V. Mace. Grand Junction, Colorado. Jan 58. 17p. Order from OTS. 50 cents. RME-105

Mobile and portable units for geochemical exploration for uranium, by C. T. Illsley, and others. Grand Junction, Colorado. July 59. 27p. Order from OTS. 75 cents. RME-131

Health and Safety

AEC group shelter, by R. L. Corsbie. AEC Facilities Division, Holmes & Narver, Inc., Los Angeles, California. Jan 60. 33p. Order from OTS. 50 cents. CEX-58.7

Fallout program, quarterly summary report, by E. P. Hardy, Jr., and others. United States Atomic Energy Commission, New York Operations Office. July 60. 250p. Order from OTS. $3.50. HASL-88

Estimating safety probabilities from fallout forecasts for Nevada test site, by Jack W. Reed. Sandia Corp., Albuquerque, New Mexico. Feb 57. Reprinted July 60. 26p. Order from OTS. 75 cents. SC-4073(TR)

Instruments

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